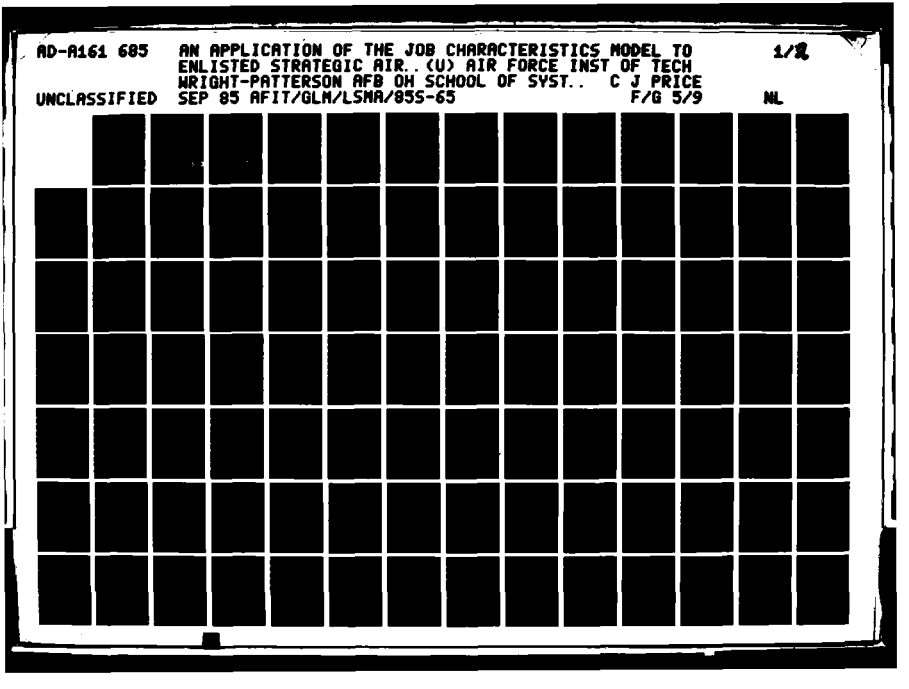
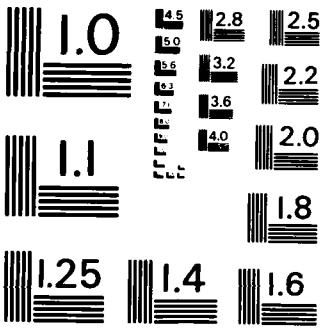

AD-A161 685 AN APPLICATION OF THE JOB CHARACTERISTICS MODEL TO ENLISTED STRATEGIC AIR.. (U) AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOOL OF SYST.. C J PRICE
1/2
UNCLASSIFIED SEP 85 AFIT/GLM/LSMA/85S-65 F/G 5/9 NL




# AN APPLICATION OF THE JOB CHARACTERISTICS MODEL TO ENLISTED STRATEGIC AIR COMMAND MISSILE MAINTENANCE CAREER FIELDS

THESIS

Craig J. Price
Captain, USAF

AFIT/GLM/LSMA/85S-65



DEPARTMENT OF THE AIR FORCE
AIR UNIVERSITY
AIR FORCE INSTITUTE OF TECHNOLOGY



Wright-Patterson Air Force Base, Ohio

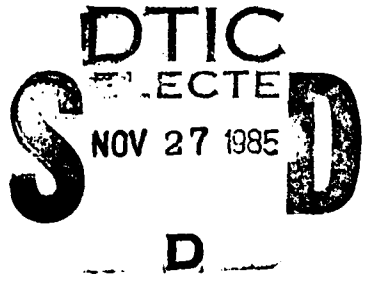
AFIT/GLM/LSMA/85

# AN APPLICATION OF THE JOB CHARACTERISTICS MODEL TO ENLISTED STRATEGIC AIR COMMAND MISSILE MAINTENANCE CAREER FIELDS

THESIS

Craig J. Price
Captain, USAF

AFIT/GLM/LSMA/85S-65



The contents of the document are technically accurate, and no sensitive items, detrimental ideas, or deleterious information are contained therein. Furthermore, the views expressed in the document are those of the author(s) and do not necessarily reflect the views of the School of Systems and Logistics, the Air University, the United States Air Force, or the Department of Defense.

AFIT/GLM/LSMA/85S-65

# AN APPLICATION OF THE JOB CHARACTERISTICS MODEL TO ENLISTED STRATEGIC AIR COMMAND MISSILE MAINTENANCE CAREER FIELDS

THESIS

Presented to the Faculty of the School of Systems and Logistics
of the Air Force Institute of Technology
Air University
In Partial Fulfillment of the
Requirements for the Degree of
Master of Science in Logistics Management

Craig J. Price, B.S.
Captain, USAF

September 1985



Approved for public release; distribution unlimited

## Preface

The inspiration for this study began nearly eight years ago when, as an undergraduate, the author spent three weeks at a Minuteman missile base (as part of "Operation Non-Com"), working with and living among enlisted members of a missile maintenance squadron. Subsequent operational missile experience in the Titan II weapon system tempered some of the earlier perceptions, and complemented the experience of working within a missile organization. This research effort was designed to specify the factors of the work and its associated environment (with respect to strategic missile wings) which most directly coincide with job attitudes, and to a lesser extent, career intent. Hopefully, the results contained herein will provide added insight into the determinants of job satisfaction so that Air Force commanders might seize opportunities, when and where they become available, to enhance the quality of work life among maintenance technicians; these workers continue to struggle with a lack of recognition for the jobs they accomplish--jobs which are vital to the nation's defense preparedness. In addition, the author hopes that this study will impress upon those officers entering the field of missile maintenance the importance of renewing the

workers' interest in their jobs and units, thereby encouraging prolonged careers in the Air Force.

The conclusions drawn are based not only on the statistical analysis of data returned by the maintenance specialists, but also on the more subjective review of written statements submitted as open-ended answers to questions regarding career intent. Certainly leadership roles, external economic factors, and individual's feelings all change over the course of time and exert an influence on the way people respond; the researcher's own bias may also color the conclusions drawn here. Thus, this study represents the cumulative feelings of specialists at one point in time, and any inconsistencies which may be revealed at a later point are likely to stem from my own inexperience in the interpretation of maintenance and leadership related matters.

I have enjoyed a great deal of assistance from others since undertaking this research project.

First and foremost I acknowledge the Lord Jesus Christ, "the author and finisher of our faith," whose guidance and support sustained me as I wrote and finished this study.

Next, I extend my sincerest thanks to Mr. Dennis Campbell who initiated the idea behind this effort and helped orchestrate its progression; through the "fog of battle," his provocative questions, firm reminders, and

personable style combined to make him an ideal advisor (a hint to future AFIT warriors).

I likewise considered the support and friendship of Captain Dennis Hull to unquestionably be a highlight of this endeavor; his practicality, organized way of doing things, and willingness to give of his time impressed on me his commitment to put people first.

I am especially thankful for Clare, my wife, whose understanding, faithfulness, and gentle assurance along the way made this effort a lot less burdensome. Her persistence in showing our children my picture is likewise commendable, for despite protracted absences at the library, they continue to recognize me as "Daddy."

I also extend a heartfelt "thank-you" to Phyllis Reynolds, who painstakingly critiqued and artfully produced the results of this study. Besides being the fastest typist in America, her IBM had an uncanny ability to get it done "the right way."

An additional thank-you goes out to each of the maintenance technicians who took the time to participate in this effort by filling out surveys. Also, I would like to express my appreciation to those in the LSMA, LSH, and LSM departments who played such a valuable role in administering the survey.

And finally, I acknowledge the memory of that saint and scholar, Martin Luther, who produced not one, but 95

theses, and defended them with not only his reputation and career interest, but also with his life.

— Craig J. Price

## Table of Contents

## List of Figures

## List of Tables

## Abstract

This study investigates the job attitudes of enlisted missile maintenance technicians (in the 411X0, 411X1, and 411X2 career fields) performing duty at each of the Strategic Air Command's six Minuteman missile wings. The overall objective of the research was to determine whether a job enrichment program might hold potential for enhancing both the quality of work life and the individuals' work motivation. The methodology consisted of measuring levels of worker satisfaction with several dimensions of the work and work environment. The instrument used to collect sample data was the "Job Diagnostic Survey."

Career intent disclosures revealed that only 37 percent of the workers surveyed had definite plans to remain in the Air Force. Forty-seven (47) percent of the technicians who did not express definite positive career intent indicated that their job was the major factor influencing their decision. Compared with a sample population of non-managerial workers, results of testing for job satisfaction showed several dimensions of the work itself to be above the national norm, while many dimensions of the contextual work factors were not; among those technicians who exhibited dissatisfaction with their jobs, the work environment factors were most highly associated with

this attitude. Analysis of growth satisfaction (the variable determined to be most highly associated with job satisfaction) revealed no significant difference between it and the national norm. The distinct absence of significantly positive indices for any of the three affective work outcomes (including job satisfaction) and the implication that a majority of the respondents were either undecided about re-enlisting or were intending to separate indicated that job satisfaction was problematic.

Results of a diagnostic analysis of the work itself show that a comprehensive job enrichment program in the three career fields is not warranted; however, attention should be given to contextual job factors.

# AN APPLICATION OF THE JOB CHARACTERISTICS MODEL TO ENLISTED STRATEGIC AIR COMMAND MISSILE MAINTENANCE CAREER FIELDS

## I. Introduction

> There are four several ways whereby this flying in the air hath been or may be attempted. Two of them by the strength of other things, and two of them by our own strength: (1) By spirits, or angels. (2) By the help of fowls. (3) By wings fastened immediately to the body. (4) By a flying chariot. (26:1)
>
> — Bishop John Wilkins (1648)

With the launch of Sputnik I on October 4, 1957, the American people awoke to the reality of Russian scientific ability, and the long-dormant interest in U.S. missile development received an impetus, the flames of which have yet to be extinguished. In the age of modern rocketing, the names of men like Eddie Rickenbacker and Chuck Yeager have given way to those of Alan Shepherd, John Glenn, Buzz Aldrin, and Neil Armstrong. Yet, the tradition continues of levying the title of hero upon those who fly--while little regard is extended to those who design, engineer and particularly those who maintain these "flying chariots." The missiles that vaulted the original seven astronauts into orbit have undergone modernization and

their capsules have been replaced with thermonuclear warheads; the missiles stand hardened within silos beneath the heartland of America and comprise the Strategic Air Command's land-based segment of the strategic triad. With the disappearance of the flyer from the guided missile came public sentiment which proposed that "push-button warfare cancels out the importance of human qualities except in passive form" (36:188). Clearly this image of automated missile warfare, devoid of the human element, would likely be the one Mencken described as "neat, plausible, and wrong" (36:188)--for the requirements that accompany every weapon system include, above all, the men and women who supervise and maintain the system. Today's Air Force maintenance technician is as vital as ever before and is clearly recognized as a key contributor to the war readiness and combat capabilities of our missile organizations (10:1). Gen Curtis E. LeMay recognized the mission's dependence upon the maintenance technician:

> Air Force personnel now assigned to maintenance duties with missile units are gaining experience that will help the Air Force to bridge the gap between manned aircraft and space vehicles. Their knowledge of guidance and propulsion components, for example, will be of particular value to the Air Force. (41:2)

The Director of Air Force Maintenance and Supply, Brig Gen Waymond C. Nutt, concluded

> There's no area in the Air Force that requires its people to work longer hours or under more difficult circumstances; few support areas in the Air Force contribute more to the operational mission--and more directly--than maintenance. (44:6)

As crucial a role as they play in the readiness of the intercontinental ballistic missile (ICBM) posture, maintenance supervisors admit that their troops are extremely low in experience and, in many instances, in motivation as well.

The primary reason for the high percentage of first-term airmen in the maintenance field is the revolving door of attrition that siphons off the top talent and experience. Ralph J. Cordiner, Chairman of the Defense Advisory Committee on Professional and Technical Compensation, said this about the problems of technology and demand for technicians in a report to the Secretary of Defense:

> Research, development and innovation on an expanding scale have become a way of life, not only in industry but in the military field as well. The Armed Forces are competing with the civilian economy for a relatively scarce resource. Technically skilled personnel are in great demand in this expanding, technically-powered economy. . . . (12:101)

This problem of retention is well documented in studies of aircraft maintenance technicians, even with the challenge and satisfaction of actually watching the outcome of their labor--a sortie-capable aircraft--accelerate down the runway and take off. In missile units the atmosphere is acknowledged to be one of even greater challenge due to the nature of the weapon system itself. An Air Force report of opinions of well informed missile maintenance personnel noted that, "Aircraft people get to see the

results of their work when the aircraft takes off. We don't. The missile just sits there" (5:46). That same report offered a general consensus that retention was poor not only for task-related reasons, but because "the whole package of pay and benefits was just not good enough" (5:137). To further exacerbate the problem, the continuing debate over how to reduce the federal deficit includes a potential plan for a 15-month freeze in military pay. DoD manpower officials are unable to predict what effect an FY 86 pay freeze would have on the military. "It would be a deterrent to recruiting and retention, but how much and how that equates in numbers of people, I couldn't say," one official quoted (29:4). Yet another variable in the retention equation that appears to run counter to Air Force desires is the dwindling manpower pool from which the military must compete for human resources. The source of this concern stems from Census Bureau data:

> . . . the size of the primary military manpower supply pool will decline significantly through 1993, and the supply of 18-year-old males will remain 20 to 25 percent below 1975 levels up to 1998. (8:1)

Finally, Budget Director David Stockman's recent denunciation of the military retirement system before Congress and the American public (via news reporters present) was perhaps the most visible indication that the traditional 20-year plan may be in trouble. The implication speaks for itself, since "for airmen, the 'retirement system'

remains the single most important factor influencing them to make the service a career" (13:65).

Since missile supervisors and managers at the unit level generally do not have direct access to potential policymakers to redress the aspect of inadequate compensation for maintenance technicians, it follows that greater intensity in matters relating to improving the job itself might be one method to improve worker satisfaction and motivation and, thereby, reduce turnover. Missile supervisors have the responsibility to take an active role in marshalling human resources toward the most effective and efficient achievement of the unit's goals not only for the benefit of the taxpayers and the organization but also as a duty to the technicians as individuals. One method designed to combat withdrawal behavior (tardiness, absenteeism and turnover) in subordinates is job enrichment.

> Several studies have demonstrated that "enriched" jobs (i.e., jobs that are complex and challenging) often enhance the motivation, satisfacition, and productivity of people at work. (34:395)

Simply stated, job enrichment assumes that problems stemming from unsatisfactory relationships between people and their jobs might be dealt with by redesigning selected elements of the jobs that are performed rather than by attempting to force, cajole, or motivate personnel so that they squeeze into the mold driven by the fixed job. Certainly, not every job is in need of redesign; but among

those whose symptoms include high dissatisfaction and high turnover rates, research indicates that applications of job enrichment in both the private and public sectors bring positive and, in some instances, spectacular results. The concept stems from the work of Frederick Herzberg and, primarily through the efforts of Hackman and Oldham, provides a set of tools (to be discussed in the methodology) for diagnosing existing jobs--and an avenue to implement action steps which are likely to impact the particular situation in a positive way. The strategy of job enrichment is

> . . . buttressed by a set of findings showing that the theory holds water, that the diagnostic procedures are practical and informative, and that the implementing concepts can lead to changes that are beneficial both to organizations and to the people who work in them. (20:70)

Examples of its success in industry are numerous, including those at the Travelers Insurance Companies and AT&T.

Job enrichment in the Air Force has made significant gains since a series of pilot projects begun ten years ago showed measurable results. AFR 66-1 dictates that

> . . . changes which cause decreases in resource requirements (such as productivity gains), should be highlighted and reinvested in the benefiting organizations as an incentive to good management. Such changes may often be used to offset increasing resource requirements in other areas. (49:7)

In SAC, a job enrichment project was completed with security specialists at a northern base in 1975. Results proved noteworthy--"job satisfaction, satisfaction with supervision, and attendance improved when compared to a group

that did not receive job enrichment" (47:19). The consistency of positive findings throughout the major commands helped bring forth a decision to make a job enrichment capability available to leaders throughout the Air Force.

Problem Statement

The readiness of the U.S. ICBM force is of paramount importance in order to execute SAC's fundamental objective of sustained deterrence. It is the men and women in the maintenance organizations--that airman or sergeant in the field who turns the wrench every day of the year, in every imaginable weather, miles removed from the upper echelons of command--who are directly responsible for achieving and sustaining the high level of readiness required. This missile maintenance environment, replete with regulations, requirements, inspections and anonymity is the source of frustrations among technicians and impacts the ability to keep a highly-trained work force in uniform for subsequent tours. As discussed, the redesign of the tasks which comprise the technician's job is one way that managers can slow the rate of turnover. Well designed jobs serve as a hedge against dissatisfaction and help promote efficiency, effectiveness, and job satisfaction in the workplace. Poorly designed jobs elicit tendencies toward low motivation, low esprit de corps, and low productivity. As

managers entrusted with a responsibility to the American public and to the Commander-in-Chief, maintenance supervisors must examine every known means to responsibly discharge their own duties. This study examines the application of job enrichment to Air Force missile maintenance organizations as a technique to enhance job satisfaction, performance and motivation among maintenance technicians.

## Scope of the Research

The subjects for this research were comprised of enlisted SAC missile maintenance personnel possessing a three, five, or seven skill level (the concept of skill level will be discussed later in this thesis) in three Air Force Specialties (AFS) designated by the following Air Force Specialty Codes (AFSC) and associated synopsis of duties:

1. (AFSC 411X0) Missile Systems Analyst Specialist--

> Monitors and operates consoles, fault display panels, and checkout equipment, performs malfunction analysis, and assembles, repairs, maintains, modifies, inspects, and services missile, missile subsystems, missile electronic systems, and aerospace ground equipment to component level. Operates checkout and test equipment, and performs adjustment, alignment, and calibration of missile and related missile aerospace ground equipment. (48:A16-7)

2. (AFSC 411X1) Missile Maintenance Specialist--

> Assembles, repairs, maintains, modifies, configures, inspects, and services missiles, missile subsystems, and related support equipment. (48:A24-7)

3. (AFSC 411X2) Missile Facilities Specialist--

Inspects, monitors, troubleshoots, operates, maintains, and repairs missile weapon systems support facilities and equipment. (48:A28-9)

Based on the current deactivation of the Titan II weapon system (scheduled to be phased out of the inventory by 1988), this study focuses on missile maintenance technicians from the six Minuteman bases. Approximately 1,000 Minuteman missiles are kept "on alert" throughout the continental United States. Minuteman is an effective deterrent to general war, and the relative simplicity of the weapon has resulted in a highly reliable system which operates at a relatively low cost (31:2). (Table 1 lists the Minuteman bases.)

TABLE 1

MINUTEMAN MISSILE BASES (3:2)

| Base | State | Number of Missiles |
|---|---|---|
| Ellsworth AFB | South Dakota | 150 |
| F. E. Warren AFB | Wyoming | 200 |
| Grand Forks AFB | North Dakota | 150 |
| Malmstrom AFB | Montana | 200 |
| Minot AFB | North Dakota | 150 |
| Whiteman AFB | Missouri | 150 |

Technicians in the three listed AFSCs stationed at Vandenberg AFB, California were excluded from the population. The mission at Vandenberg is solely dedicated to the training of new missileers, so the environment is not entirely consistent with that of an operational base. Additionally, missile technicians in the 411X0 and 411X1 career fields assigned to Ground Launched Cruise Missiles (GLCM) were excluded from the population due to the dissimilarity of that weapon system from the Minuteman in terms of hardware, maintenance concept and basing. (There are no 411X2 assignments in GLCM.) The total of the remaining population, including the three focal career fields, is determined to be 2275 (7).

Purpose and Objectives

The purpose of this study is to diagnose the tasks accomplished by SAC missile maintenance technicians in three AFSCs: Missile Systems Analyst Specialist, Missile Maintenance Specialist, and Missile Facility Specialist. The Job Diagnostic Survey (discussed at length in the methodology of this report) will facilitate the collection of data to analyze the following:

1. Determine if any of the selected AFSCs exhibit low job satisfaction or low motivation.

2. Determine if any of the selected AFSCs are low in motivating potential.

3. If the AFSC is rated as low in motivating potential, determine what specific aspects are causing the difficulty.

4. Analyze the selected AFSCs to ascertain how "ready" the technicians are for job redesign.

Investigative Questions. In order to effectively evaluate the selected AFSCs the following investigative questions are proposed:

1. What is the perceived level of job satisfaction in the selected maintenance career fields?

2. What is the perceived level of internal work motivation in the selected career fields?

3. What is the perceived level of growth satisfaction in the selected career fields?

4. Are any of the selected maintenance career fields rated low in motivating potential?

5. What specific aspects of the job are contributing to low job satisfaction, low internal work motivation, or low growth satisfaction?

6. Are personnel in the selected career fields satisfied with elements of the work environment?

7. Are maintenance personnel ready for change in the design of work (as measured by their growth need strength)?

The actual hypotheses to be tested are logical extensions of these investigative questions and appear in the analysis section as well as in Appendix B of this report. Hypothesis testing is performed among the results generated by the individual AFSCs and between the national norms established for non-managerial workers (10).

Limitations

Several limitations affect the overall design of this research. Perhaps the primary limitation is the fact that time and organizational constraints allow only a diagnosis of the missile maintenance environment with respect to task redesign; any actual implementation which could lead to improvements in the various aspects of work (see Appendix A for the "implementing concepts" proposed by the job characteristics model) as well as research to document the benefits of such a program, should it be warranted, is beyond the scope of this report.

A second limitation stems from the use of the Job Diagnostic Survey to measure job satisfaction. Since what is measured are attitudes, it is difficult to quantify job satisfaction on an absolute scale (15:14).

Finally, it is likely that not all workers want their jobs enriched. Some technicians in the target population may always prefer jobs that do not require any emotional or mental commitment to the work setting (15:12).

## II. Literature Review

> Now there arose a new king in Egypt . . . [and] he said to his people, "Behold, the people of Israel are too many and too mightly for us. Come let us deal shrewdly with them, lest they multiply . . . and fight against us." Therefore they set taskmasters over them to afflict them with heavy burdens . . . and made their lives bitter with hard service, in mortar and brick, and in all kinds of work in the field. . . . And the people of Israel groaned under the bondage, and cried out for help.
>
> — Exodus

Although the murmurs of disheartened laborers echo from some of the earliest manuscripts in existence, much of the theoretical work in task design is credited to relatively recent ideas proposed by scholars in the discipline of behavioral science. This chapter examines the job enrichment approach to redesigning work by outlining several prominent theories proposed to date; additionally, this review of the literature provides a link between the stated objectives of the report and the methodology used to gather and analyze the data. Support for job enrichment stems from documented applications in private industry and in the Department of Defense, several examples of which are included. The chapter closes with a discussion of the structure and environment of the Minuteman maintenance complex at a typical SAC missile wing.

Job Enrichment

Job enrichment is a concept which seeks to improve

> . . . both task efficiency and human satisfaction by means of building into peoples' jobs, quite specifically, greater scope for personal achievement and its recognition, more challenging and responsible work, and more opportunity for individual advancement and growth. It is concerned only incidentally with matters such as pay and working conditions, organizational structure, communications, and training, important and necessary as these may be in their own right. (21:61)

It draws from two earlier concepts, relatively unsuccessful in and of themselves, known as job rotation and job enlargement. They are defined as follows:

1. Job rotation--involves the systematic movement of employees from one job to another (14:4). Unfortunately, this approach was not successful in helping solve worker motivational problems, "since it became clear that all that was done was to subject the worker to a series of boring tasks, not just one" (43:413).

2. Job enlargement--is a concerted attempt to stem and even reverse the current trends among industrial engineering programs toward job simplification and specialization (24:41). It was the first approach that involved a change in the actual job, and entailed giving the worker more to do by increasing the work cycle (43:143).

The concept of work redesign is used synonymously with job enrichment in the literature and is a more generic classification involving attempts by organizations to improve the nature of workers' tasks.

A sound employment situation is one in which technicians and managers cooperate to direct meaningful work toward achievement of an organization's goals. To this end, three basic characteristics can be ascribed: (1) a complete piece of work, identifiable from beginning to end by the person performing the task; (2) one in which the worker has as much decision-making control over the accomplishment of the piece of work as possible; and (3) one in which the worker receives feedback on performance in a direct and frequent manner (6:30). In answering the question of the importance of these characteristics, a series of studies done at Yale University "suggests that it is possible to achieve both high employee satisfaction and good job performance if jobs are designed in accordance with employee needs" (6:31).

To enable such studies to be taken required an extensive foundation of insight, research, and criticism to accumulate; Frederick Herzberg pioneered much of the work in the motivational concepts of job enrichment theory and in its practical application in business settings.

Herzberg's Motivation-Hygiene Theory. From the widely documented Hawthorne Studies conducted by researchers from the Harvard Business School in the 1920s, the seeds of the human relations movement grew in a rather fragmented manner until 1959, when Professor Frederick Herzberg

published The Motivation to Work. This book generated significant interest and acceptance. Herzberg's motivation-hygiene (or two-factor) theory was proposed therein and became the cornerstone of research on effective employee motivation. Based on interview data collected from 200 accountants and engineers working in Pittsburgh, the study sought to determine what factors caused employees to feel satisfied and/or dissatisfied with their jobs. He concluded that two separate categories of factors existed in the workplace. First, the intrinsic factors (i.e., recognition, achievement, responsibility, advancement, personal growth and development) he called "motivators" because they led (in theory) to increased levels of effort and performance by employees. A second set of factors was related to the job context, which when absent, led to the workers feeling dissatisfied. "When present and acceptable, though, employees were not necessarily satisfied; they were simply 'not dissatisfied'" (20:57). Once a level of acceptable economic and social satisfaction has been realized by employees, changes that deal only with these "hygiene" factors are pointless; it is doubtful that any further increase in worker motivation would result. "To operationalize the motivation factors generally involves enriching tasks along certain lines" (14:28).

Empirical research shows mixed results for the theory. To his credit Herzberg has played a role in

several successful projects involving job redesign, particularly the series of studies done at AT&T. These studies showed that job enrichment could lead to outcomes beneficial to not only the individuals in the work settings, but for the employing organization as well. Overall, the effect of the Herzberg motivation-hygiene theory is "to point attention directly to the significance of the work itself as a factor in the ultimate motivation and satisfaction of employees" (20:58).

A number of shortcomings have been identified with the theory, several of which are pointed out by Herzberg himself (22:102-103). First, the theory is concerned with worker satisfaction yet predictions follow which concern worker motivation. No causality or linkage between satisfaction and motivation is provided. Second, some of the factors listed by workers that caused them to feel particularly good about their work might have been a function of what Vroom described as "people tending to take the credit when things go well, but protecting their own self concept when things go poorly by blaming their failure on the environment" (14:31). Third, accountants and engineers may see their jobs differently than do other groups of workers; similarly, employees in a heavily industrialized urban center such as Pittsburgh may have a different outlook on their work than those in less industrialized cities. Other less obvious criticisms exist as well; however, the

fact remains that the motivation-hygiene theory is

> . . . simple, persuasive, and directly relevant to the design and evaluation of organizational changes, and thus continues to be widely known and generally used by managers in this country. (20:58)

It also served as the basis for the task design research discussed in more detail later in this chapter.

Behavioral scientists consider Herzberg's two-factor theory to be content theory of motivation in that it focuses on the question of what arouses, energizes, or starts behavior. Emphasis here is placed on needs (considered to be internal qualities of a person) and their fulfillment. However, Herzberg's theory provides little insight into why people choose a particular behavior to satisfy their needs. The following discussion examines a process or "cognitive" theory, initially forwarded by Victor H. Vroom, which attempts to look at the mental (choice oriented) process in an effort to understand how motivation occurs (43:399,405).

The "Expectancy Theory" Model of Motivation. Vroom's expectancy theory basically concerns choosing behavior that can lead to desired rewards. He viewed behavior as a function of expectations people have that their behavior will lead to outcomes and, equally important, the desirability of those outcomes. Vroom contributed the three primary elements of expectancy theory (expectancy, instrumentality, and valence) which, two

decades later, are still widely accepted in their original form by a host of researchers, psychologists, and academicians.

Expectancy, as postulated by Vroom is the belief that an act will be followed by an outcome. Stated another way, it is the perceived relationship between effort and performance. Instrumentality, by definition, is the belief that one outcome will lead to the attainment of other outcomes. Many rewards are known to have additional consequences which may be as influential as the original reward itself. The third variable, valence, is the degree to which a person values a particular outcome.

In a work setting, the expectation is that outcomes or rewards such as recognition, pay increases, and promotion would have positive valences, while outcomes such as reprimands, interpersonal conflicts, and job stress would have negative valences (42).

> The model asserts that the probability of a person performing an act is a direct function of the algebraic sum of the products of the valence of outcomes and expectancies that they will occur given the act. (50:276)

This motivational relationship is expressed as:

Valence x Expectancy = Motivation

As with other theories in the field of applied psychology, criticisms have surfaced, primarily regarding the complexity of the expectancy theory. Doubt has been expressed by some researchers when they consider whether

people actually work through expectancies, instrumentalities, and valences every time they are motivated (43:408). Overall, however, the theory is a valuable contribution to the understanding of worker motivation. It not only emphasizes the involvement of both arousal and behavior choice in the motivation of employees, but also has other practical implications for managers. For instance, supervisors may be able to increase performance by managing intrinsic rewards in addition to extrinsic ones. Also, managers are encouraged to link performance to outcomes in appraisal sessions (feedback will be discussed at greater length in the next section). Finally, since research indicates valences vary from individual to individual, supervisors may be able to increase performance and satisfaction by giving those rewards to individuals to whom they mean the most and making them commensurate with the level of behavioral change desired (42).

The Job Characteristics Model. In a classic illustration of the building-block approach to effective research, Hackman and Oldham produced a highly useful framework of task design processes based on previous models of motivation (most notably Herzberg's two-factor theory). This framework, called the job characteristics model (see Figure 1), was presented "in an attempt to extend, refine, and systematize the relationships between job characteristics and individual responses to the work" (18:255).

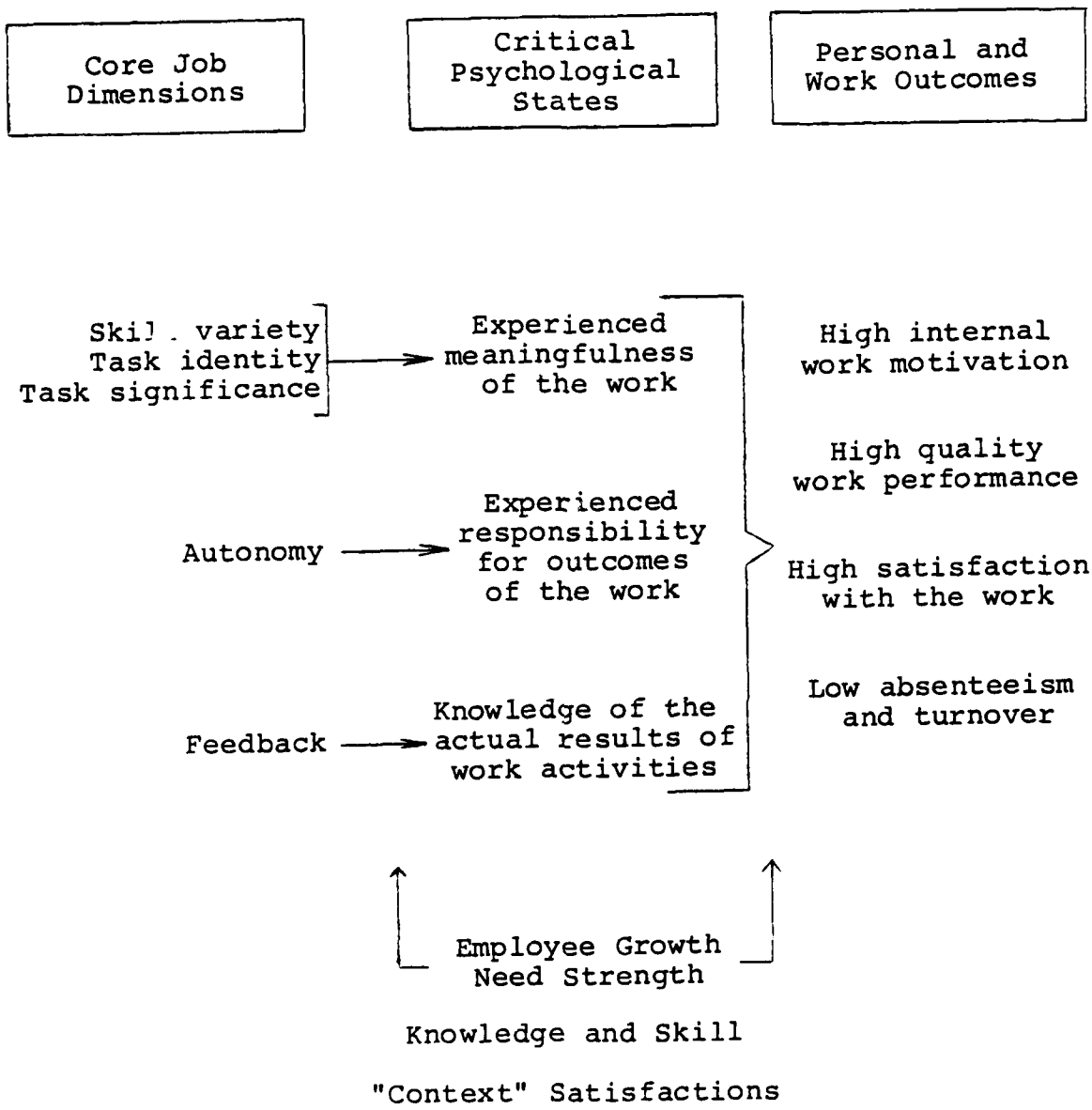



Fig. 1. Job Characteristics Model of Work Motivation (18:256)

As stated, the job characteristics theory "shows what kinds of jobs are most likely to generate excitement and commitment about work, and what kinds of employees it works best for" (20:57).

The causal core of the theory is depicted by three critical psychological states. These "are seen as primary determinants of employee motivation and satisfaction, as defined below" (14:39):

1. Experienced meaningfulness of the work. The degree to which the individual experiences the job as one which is generally meaningful, valuable, and worthwhile;

2. Experienced responsibility for work outcomes. The degree to which the individual feels personally accountable and responsible for the results of the work he or she does;

3. Knowledge of results. The degree to which the individual knows and understands, on a continuous basis, how effectively he or she does at performing the job.

When these three conditions exist, the employee will very likely have a positive feeling about himself when he performs well. Additionally, motivation will decline significantly if one of the three psychological states is missing. These conditions are intrinsic to the work itself; Herzberg would consider them to be "motivators" because they are independent of external factors (such as a pat on the back

from a leader). As such, they represent powerful concepts in any effort to understand the relationship between job characteristics and individual response.

The theorized relationship between the three psychological states and "personal and work outcomes" is illustrated in the right-hand portion of Figure 1. "When all three are high, then internal work motivation, job satisfaction, and work quality are high, and absenteeism and turnover are low" (20:59). "Causal priorities among the several outcome variables, however, are not explicitly addressed by the model" (18:259).

The three key psychological states which give rise to these important on-the-job outcomes are themselves thought to be brought about by the presence of what Hackman and Oldham describe as five core job dimensions. Shown on the left-hand side of Figure 1, "three job characteristics contribute to the experienced meaningfulness of the work, and one each contributes to experienced responsibility and to knowledge of results" (18:257). Collectively, the five core job characteristics enable researchers to objectively measure jobs and then, in cooperation with the manager, to change them, so that they have high potential to motivate those workers who perform them (20:59). The five core dimensions are defined as follows (6:33):

1. Skill variety. The degree to which the job requires the employee to utilize a number of skills and abilities;

2. Task identity. The degree to which the job involves the completion of a whole and identifiable task is clearly more meaningful (e.g., to assemble a complete shaver rather than endlessly attach electrical cords);

2. Task significance. The degree to which the task has a substantial and perceivable impact on the lives of other people;

3. Autonomy. The degree to which the worker has discretion in scheduling work and deciding how it is to be carried out;

5. Feedback. Does the employee get frequent (and reliable) answers to the question, "How am I doing?" In other words, feedback is most powerful when it comes directly from the work.

According to Hackman and Oldham, the overall potential of a job to elicit internal motivation in workers should peak when the job is "(a) high on at least one (hopefully more) of the three job dimensions that lead to experienced meaningfulness; (b) high on autonomy, and (c) high on feedback" (18:258). These five characteristics can be grouped into a single index called the Motivating Potential Score or MPS. The MPS is used to assess how "enriched" jobs are and is computed as follows (34:396):

$$\text{Motivating Potential Score (MPS)} = \left[\frac{\text{Skill Variety} + \text{Task Identity} + \text{Task Significance}}{3}\right] \times \text{Autonomy} \times \text{Feedback}$$

Techniques for measuring the five core job characteristics are discussed in the methodology section of this report. It should be noted that the MPS of a job does not cause workers on that job to become highly motivated or satisfied. Rather, a job with a high motivating potential "merely creates conditions such that if the jobholder performs well he or she is likely to experience a reinforcing state of affairs as a consequence" (17:82).

Hackman and Oldham acknowledge the existence of three primary moderators of the relationship between the job characteristics and internal motivation. These factors include a worker's job-relevant knowledge and skill; level of satisfaction with aspects of the work context; and growth need strength (17:88). The existence of these moderators essentially indicates that differences among people change (or moderate) how they interact with their work. For example, workers with sufficient knowledge and skill to perform well will exhibit positive feelings as an outcome of their work if the job is high in motivating potential. However, people will display unhappiness and frustration at the same job if they are not competent enough to perform well, because it "matters" to them they they fell short of their sights. Additionally, employees

who are satisfied with aspects of the work context (pay, job security and co-workers, for instance) will likely respond more positively to interesting jobs than those workers who are dissatisfied with their environmental surroundings (17:86). Finally, individuals who have a high need for personal accomplishments will turn on eagerly when they have jobs high in motivating potential (their growth need strength is high). Workers whose growth need strength is low and do not value the internal rewards may respond with less enthusiasm or, in some instances, with resentment (6:38). The implication here is that before researchers attempt to enrich jobs, "they should assess both individual differences in needs and contextual sources of dissatisfaction" (34:402). Efforts to implement job enrichment should proceed with caution, or should be delayed if workers show a lack of growth need strength and/or are substantially dismayed over pay or other environmental conditions (34:402).

Empirical support comes from earlier studies in the field of task design. Turner and Lawrence reviewed the literature and acknowledged six core dimensions, including variety, autonomy, knowledge and skill, interaction (required and optional), and responsibility (45:20). "Measured across 47 jobs these dimensions were all closely related, suggesting unidimensionality" (37:92). Hackman and Lawler proposed four core task dimensions (variety,

autonomy, task identity and feedback) and found them "significantly and strongly related to job satisfaction measures" (46:380). Hackman and Oldham refined the instrument to measure task characteristics even further with their Job Diagnostic Survey (JDS); they used this tool to obtain data from 658 workers from 62 different jobs in seven organizations (18:258). The JDS produces measures of core dimensions "with reliability estimates typically above .70" (37:93). Thus, the available empirical research suggests that task design often has a positive relationship with various employee responses (37:93).

A review of the methodological designs that have been employed to develop this theory reveals several concerns which, to date, have not been fully explained. For instance, some studies discussed individual differences yet made sociological level measures. Further, evidence for the proposed moderating effects is scattered. Besides the few studies which have systematically tested the theorized moderators, several other individual difference variables (such as alienation from middle-class work norms and intrinsic versus extrinsic work values) have been proposed as alternatives to growth need strength (17:95). Additionally, the links between the job characteristics and the psychological states may not be as neat and clean as was proposed in Figure 1. For instance, several of the job characteristics (particularly autonomy) appear in some

studies to affect psychological states other than those specified in the model (17:95). Next, the assumption that the chosen job characteristics are independent (that is, mostly uncorrelated with one another) may not always be the case. For example, in many organizations skill variety and autonomy are especially closely intercorrelated. Thus, simply summing the scores of the job characteristics may prove to be just as good an estimate of the motivating potential of jobs in some instances as using the more complex MPS formula (17:96). Also, Hackman and Oldham concede that the construct of feedback presented in the model may contain inaccuracies. The primary flaw stems from the omission of feedback from nonjob sources (such as one's self) that also affect knowledge of the results of the work. Frequently, in fact, supervisors, job incumbents, and outside observers disagree about how much feedback a specified job provides (17:96). And finally, it is not completely clear how the objective properties of jobs relate to peoples' perceptions of those properties (the JDS actually measures perceived levels of job characteristics). Stated in other words,

> It is not known whether the motivational benefits of "enriched" work derive primarily from objective task characteristics or from employee perceptions of task characteristics. (17:97)

The literature shows a number of other issues which need to be pursued, particularly to redress the fact

that carefully controlled experimental work on job enrichment in general is often lacking (17:330).

There is support in the research literature for the basic job characteristics model, however, and despite its apparent weaknesses and limitations, the job characteristics model can be a useful tool in the field of job diagnosis and enrichment, yielding valuable insight into aspects of job design which are limiting organizational effectiveness (10:36).

## Applications of Job Enrichment

Job redesign is not listed among the newer concepts in the field of management. Its demonstrated practical value, however, continues to prompt interest among researchers and practitioners in their quest for increased worker productivity. Knowledge based on the relationship between technology, job design, productivity, and employee social behavior has been traced in the literature to London's Tavistock Institute in the 1950s (51:11). In a historical synopsis, Yorks (51) cites benchmark studies in job design ranging from the Ahmedabed Textile Mills on the Indian subcontinent to applications in American firms including IBM and AT&T (11).

While the job characteristics model has been the subject of a substantial amount of attention in the past decade, Griffin points out in his book Task Design that,

". . . few actual assessments of the complete theory have been presented" (14:40). Hackman and Oldham present evidence which generally supports the theory in their test of the model. That same year (1976) two studies based on limited job enrichment projects produced mixed results. In a two-phase research investigation on productivity and satisfaction, Umstot, Bell, and Mitchell found that job enrichment had a substantial impact on job satisfaction but little effect on productivity (46:379). However, an experimental case study designed by Locke, Sirota, and Wolfson to determine the effects of job enrichment on attitudes and behaviors of clerical employees in a large federal bureaucracy indicated that "job enrichment apparently had no effect on attitudes" (27:701). This outcome is puzzling in the sense that a large number of studies testing a task design-motivation linkage have been supportive of that relationship's existence (14:58).

Perhaps the most definitive test of the theory was conducted by Christopher Orpen in South Africa in 1979. The effect of job enrichment on employees was investigated in a field experiment conducted in a federal agency among clerical employees, who were randomly assigned to either an enriched or unenriched condition. In the enriched condition, a systematic attempt was made to enhance the dimensions of skill variety, task identity, task significance, autonomy, and feedback. In the unenriched condition,

the workers continued to perform their routine tasks. Following a six-month experimental period, the overall effect of enrichment revealed: (1) enrichment caused significant increases in employee job satisfaction, job involvement, and internal motivation; (2) enrichment led to significant decreases in absenteeism and turnover; but (3) enrichment had little impact on performance. These findings suggest that enrichment can cause substantial improvements in employee attitudes, but that these benefits might not generate higher productivity. Orpen asserted that in order to explain the effect of enrichment on performance, it is necessary to consider other variables besides the three psychological states produced by jobs which are seen to have certain characteristics (35:189). Additional support was reported by Brief and Aldag (2) following a partial replication of the model which yielded significant, positive correlations between job dimensions and employee reactions.

In the mid-1970s the U.S. Air Force recognized the potential usefulness of the job enrichment concept and incorporated a version of Hackman and Oldham's model (as modified to include goal clarity as a core dimension) as a test project in a number of combat support units. Under Frederick Herzberg's direction, the Air Logistics Center (ALC) at Ogden, Utah experienced enough success to warrant the expansion of job enrichment programs to all five ALCs.

The defense budget cutbacks, and subsequent emphasis on enhanced productivity among Air Force leaders during the latter half of the seventies led to the development of a job enrichment capability which was no longer limited to the civilian work force at Air Force Logistics Command (AFLC). Projects conducted in both the Strategic Air Command and Tactical Air Command showed encouraging results when compared to a control group, as manifested by improved morale, job satisfaction, attendance, and satisfaction with supervision (47:19). A cadre of Air Force officers became trained in the diagnosis and implementation of job enrichment concepts in an effort to further the principles of the theory and enrich the jobs performed by airmen serving in a wide variety of AFSCs. A more thorough description of job enrichment as applied to Air Force settings is presented in a paper by Herzberg and Refalko (23) based on projects at Hill Air Force Base, Utah.

In summary, the passage of time and change of command throughout the top tiers of management have brought a diminished emphasis to job enrichment in the Air Force; however, the concept continues to be a subject of extensive research in the field of applied behavioral science.

Missile Maintenance

In contrast to the explosion of interest and published material in the field of work redesign and job

satisfaction since the 1960s, a relative paucity of literature pertaining to missile maintenance exists. This section of the literature review provides a cursory examination of some studies in the field of missile maintenance and outlines the Minuteman concept and the current wing and squadron organizational structure. The intent is to provide a thumbnail sketch of the maintenance tasks and environment that characterize the six Minuteman bases, to allow a more thorough understanding of the analysis to follow.

August of 1945 brcught the first public demonstration of the notion that a runaway multiplication of neutrons in a piece of fissionable material could be made to continue long enough for a nuclear explosion to occur. The energy was so great, and was released in such a short time, that for an instant, the temperature at the center of the explosion was many times higher than that at the sun's center. Thus a tool that could in effect deliver pieces of the sun's interior to the earth's surface was added to the traditional tools of warfare (38:14). The Minuteman weapon system encapsules this potential tool of destruction in its nosecone and accounts for over 60 percent of the United States' nuclear alert force (25:6).

One assumption that conditions this report is that because only 100 Peacekeeper (formerly referred to as "MX") missiles are being planned and the number of small ICBMs produced is expected to be relatively limited, the Minuteman

ICBM will continue to constitute the bulk of the U.S. land-based nuclear missile force.

Even as ICBM vulnerability became a more pressing issue with the advent of reportedly highly accurate modifications of such MIRVed Soviet ICBMs as the SS-18 and -19, survivable basing remained a firmly entrenched component of the U.S. strategic triad. In April 1983, the President's (Scowcroft) Commission on Strategic Forces supported the continuity of the Minuteman force by reporting:

> Whereas it is highly desirable that a component of the strategic forces be survivable when it is viewed separately, it makes a major contribution to deterrence even if its survivability depends in substantial measure on the existence of one of the other components of the force. (32:24)

To sustain the effectiveness of the Minuteman missiles through the year 2000, the Air Force is planning to invest approximately $4 billion over the next ten years in Minuteman improvements (40:27). General Scowcroft himself told the House Armed Services Committee:

> We found out in the Commission that [most researchers] were looking at a single way to harden silos: thicker walls, more reinforced concrete, more structural steel and so forth. We suggest . . . that we have to harden by a different technique, by what we call shock absorbers, crushable structural steel implacements outside the perimeter of the silo, which can very easily be done on the existing Minuteman. This crushable structural steel embedded in cement would absorb the shock waves through the earth and from above. (32:27)

This hardening revolution (based on observed Soviet techniques as well as on new evidence that nuclear ground

bursts create narrower but deeper craters than previously thought) indicates hat the Minuteman weapon system is likely to remain as a viable strategic offensive threat to communist nations throughout the next decade and perhaps longer. U.S. policy continues to dictate that regardless of how much hardness is built into the Minuteman system, its primary objective (along with manned bombers and submarine-launched ballistic missiles) is to provide for deterrence against possible Soviet aggression.

The Minuteman Concept. The Minuteman weapon system is a hardened and dispersed complex of solid propellant ICBM facilities under the command of a series of manned underground launch control centers. The centers are designed to enable the effective launch of programmed missiles during and/or after nuclear attack. The system also incorporates features that allow for extended survival of the operational crew members (1:1).

The desire to locate the land-based leg of the strategic triad away from high population areas of the United States coupled with range considerations, resulted in the majority of the Minuteman wings being located on the "Northern Tier." The desirability of military service in these regions (Rapid City, South Dakota; Great Falls, Montana; Cheyenne, Wyoming; Minot and Grand Forks, North Dakota; and central Missouri) is hypothesized by the author

to be a potential element of overall dissatisfaction among those associated with missiles and is addressed further in later chapters.

The typical wing consists of either 150 or 200 unmanned launch facilities (LFs) and 15 or 20 manned launch control facilities (LCFs), respectively. To minimize the potential damage received from any single attacking weapon, all facilities are separated by a designated distance. This dispersion results in the average site being approximately 70 miles from the Air Force base that supports the complex (25:7).

Since its initial deployment in the early 1960s, Minuteman has had a clearly superior operational ready rate among those strategic weapon systems in the field. The measure of success has long been the strategic alert indication (or "green light") in the launch control center. This strategic alert light is indicative of the weapon system's capability to perform its intended mission, vis to launch upon lawful order. However, in consonance with U.S. policy that strategic weapons will not be fired in a first-strike capacity, the strategic missile wings are responsible for insuring that the designed-in hardness features are maintained to specifications, a factor that the "green light" is not able to monitor.

> For example, if a radiation protection seal is damaged, no electronic system monitors it or displays its status. Consequently, real system reliability may be

> something less than what is indicated by the "green light" status. (25:10)

Additionally, since facilities and equipment are often undisturbed for lengthy periods of time, effective maintenance technicians are dispatched to the missile complexes.

Thus, while Minuteman design (response time and hardness) is important, it alone cannot insure that the system would be able to perform its mission in time of war. Ultimately, it is the people who operate and, particularly, those who maintain the missiles who actually determine the overall capability. The following section describes the maintenance organization's makeup and contribution to that end.

Maintenance Organization. The Minuteman maintenance unit in an ICBM wing follows a concept which uses decentralized specialists and strong centralized control in an effort to fulfill Air Force maintenance policy. In terms of ICBM maintenance, this policy espouses that:

> All maintenance actions and all of management's efforts must be dedicated to support of the Single Integrated Operations Plan (SIOP). A high alert rate is required; however, it must be the product of effective and safe management of assets without compromise of safety, security, or maintenance discipline. (49:1-1)

Several additional directives warrant attention in this discussion, including:

> [1] Quality maintenance depends on the integrity of the individual technician, who must accomplish his tasks properly, regardless of the environmental conditions. (25:13)

[2] Management must place emphasis on timely, high-quality, base-level inspection, repair, and modification of equipment. (25:13)

[3] Missiles are not removed from alert for the sole purpose of accomplishing routine action time compliance technical orders, minor maintenance, or corrosion control actions. (25:33)

[4] Maintenance actions performed in the field primarily consist of removal and replacement of drawers or major components. (25:13)

[5] Specialized maintenance tasks performed at Minuteman missile sites are primarily accomplished by functional maintenance teams consisting of a team chief and attached specialists. These teams are dispatched as a basic or individual team, or as a composite team, which is a basic team augmented by additional specialists. (25:14)

[6] People are a manager's most valuable asset, and managers and supervisors must insure that their people are equipped, trained, and motivated to perform effective, quality maintenance. (9:7).

The Deputy Commander for Maintenance. At the base level, overall responsibility for the maintenance of the wing's missiles rests with the Deputy Commander for Maintenance (DCM), who is accountable to the Wing Commander. Figure 2 depicts this organizational structure. The DCM is required to plan, schedule, control, and direct all maintenance resource utilization to meet mission needs.

Maintenance Staff. The maintenance staff structure consists of Quality Control, Maintenance Control, Training Management, and Maintenance Management divisions as well as a Maintenance Superintendent to assist the DCM in carrying out the plethora of responsibilities assigned.

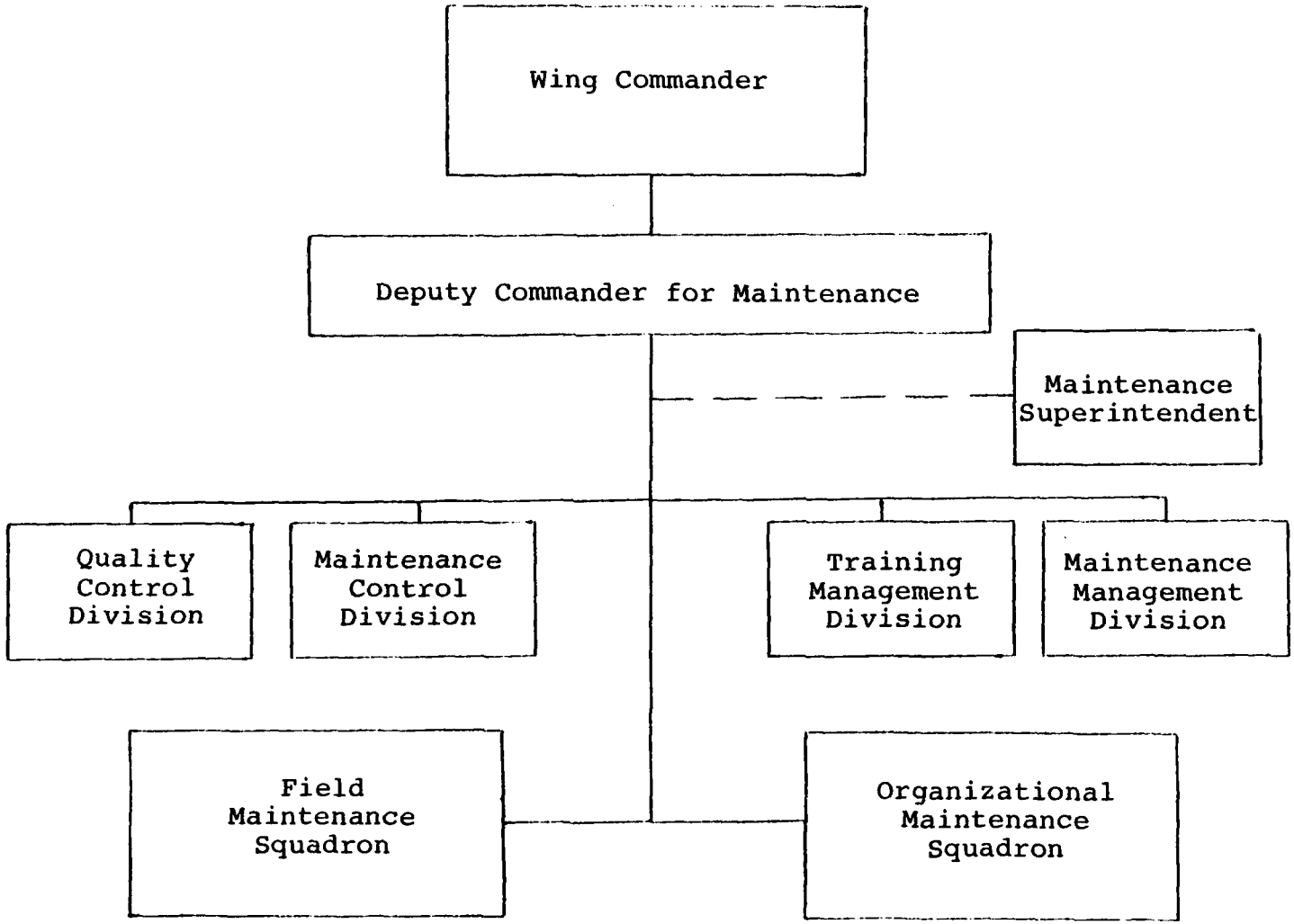



Fig. 2. Minuteman Wing Maintenance Organization

The Quality Control division personnel endeavor to ensure effective maintenance operations through inspections and evaluations of maintenance actions, procedures, equipment, and facilities. Quality Control administers the Maintenance Standardization and Evaluation Program (MSEP) in an effort to achieve a high standard of quality maintenance and they monitor the currency and applicability of technical data. In addition to checking the management of activities in maintenance work centers via 180-day activity inspections, Quality Control conducts technical inspections on a random basis at launch facilities, launch control facilities, on in-shop maintenance actions, and on support equipment. To ensure the quality of maintenance being performed, this division evaluates each maintenance technician at least annually while the technician is performing his job; special one-time or unusual situation inspections complement the regulatory and judicial functions of Quality Control.

The Maintenance Control Division provides centralized control of the teams which perform the "hands-on" production effort. As such, these personnel serve as the central nervous system of the missile maintenance complex, ensuring that all actions are scheduled, planned, and controlled. The division has three branches to accomplish these responsibilities: Job Control, Scheduling Control, and Materiel Control.

Job Control directs and controls the daily maintenance effort and maintains the status of all LFs and LCFs in the wing. Job Control personnel log discrepancies on appropriate status boards and in the computer data base when malfunctions are reported from an LCF. If the malfunction is a high priority job or if an emergency condition exists, Job Control will either divert a maintenance team from another job at a neighboring site, or schedule a maintenance team from the base on a priority dispatch to the field. If the malfunction is such that an immediate response is not required, it then becomes the responsibility of the Scheduling Control Branch (3:5).

Personnel from the Scheduling Control Branch review the outstanding malfunctions requiring maintenance, match the available resources such as tools, vehicles, maintenance shop personnel, and maintenance teams to known work requirements, and schedule the date and time these resources will be used to correct the malfunction. Also, Scheduling Control provides a work package for each job and coordinates it with the appropriate work center supervisor to ensure that fully qualified personnel are assigned to each task (3:5).

Materiel Control provides coordination between maintenance and supply, and manages acquisition requests for the entire maintenance substructure (9:12).

The Training Control Division manages each facet of the wing maintenance training program. It schedules, monitors, and controls formal upgrade training, job qualification training, management training, general training, and special as well as recurring training requirements that may be generated. Training Control consists of two branches: Training Management Branch, whose mission is to train individual technicians and a Team Training Branch (TTB) whose responsibility lies in training technicians to perform as effective, coordinated teams (9:10-11). In order to realize the maximum benefit from the training program, each Minuteman wing has an off-base actual launch facility which is dedicated to training as long as readiness conditions allow, as well as a training launch facility, which is essentially an LF simulator (25:23).

The Maintenance Management Division provides such support to the rest of the DCM staff agencies as administration, production analysis, data automation, support plans and programming and financial reporting. In addition, this division provides a Technical Engineering Branch which is more directly related to the business of maintenance production.

> This branch provides the chief of maintenance with the expertise to resolve immediate weapon system problems beyond the troubleshooting procedures of normal technical data or normal skill of assigned technicians. It also provides the chief of maintenance with an engineering capability for investigating recurring weapon system equipment deficiencies and for determining the

> action to be taken for these problems. Technical engineering personnel are qualified engineers and ballistic missile systems analysts who have been specially selected and trained to analyze, isolate, and resolve weapon system problems beyond the scope of normal technical data and technical training. (25:24)

Finally, the DCM has an enlisted maintenance superintendent who serves as the primary observer of the day-to-day maintenance production effort. Besides providing this feedback, the superintendent also functions as a vital link between the enlisted force and the DCM (9:10).

The Missile Maintenance Squadrons. The line (production) function of the Minuteman wing's maintenance deputate falls on the shoulders of the two missile maintenance squadron commanders and their respective units: the organizational missile maintenance squadron (OMMS, which directs its efforts toward organizational level maintenance), and the field missile maintenance squadron (FMMS, which concentrates primarily on intermediate level maintenance).

The squadron commanders each have a maintenance supervisor to whom they delegate authority for the technical supervision and maintenance production of the entire squadron. The squadron commander is thereby freed to focus concern on the remaining aspects of command including: organizing resources, providing mission orientation, insuring safety and security, providing for the welfare

and morale of the troops, and administering discipline and military justice.

Branch Chiefs are responsible to the maintenance supervisor for the management of specific functional areas which are subdivided into shops or team sections. Section chiefs, primarily concerned with jobs scheduled by maintenance control, are responsible to their respective branch chiefs for the management and supervision of assigned maintenance technicians. Team chiefs are responsible for the actual maintenance production work accomplished both at the missile sites and in the shops on base (9:16).

Field supervisors (maintenance officers and NCOs) serve as an extension of the maintenance supervisor to implement his policies and monitor the maintenance discipline, adherence to technical data and compliance with safety rules of the maintenance technicians while in the field (25:15).

There are primarily five kinds of missile team sections which provide technicians for dispatch to the field to perform maintenance: Electro-Mechanical Teams (EMT), Missile Maintenance Teams (MMT), Missile Handling Teams (MHT), Facilities Maintenance Teams (FMT), and Periodic Maintenance Teams (PMT). A brief description of each type of team follows.

EMTs consist of two or three airmen with the 411X0 (formerly 316X0) AFSC. These technicians monitor and

operate consoles, panels, and checkout equipment, perform malfunction analysis, as well as assemble, repair, maintain, modify, inspect, and service the missile, its electronic systems, and associated ground equipment to component level.

MMTs are composed of five or six airmen assigned the 411X1 (formerly 443X0) AFSC. These technicians, as the name suggests, perform maintenance on the missile itself. MMTs assemble, repair, maintain, modify, configure, inspect, and service missiles, missile subsystems, and related support equipment (3:18).

MHTs similarly consist of five or six airmen designated by the 411X1 AFSC. These enlisted personnel, however, perform removal and replacement of missiles at LFs, and on-load and off-load missiles into/from aircraft and rail cars (3:19).

FMTs are composed of two or three airmen assigned to the 411X2 (formerly 445X0) AFSC. They perform tasks associated with the power distribution system at the missile complex and work on the site environmental control system (3:19).

PMTs primarily perform preventive maintenance, in contrast to the four teams described above (which are concerned chiefly with corrective maintenance tasks). PMTs consist of five or six technicians who hold the 411X2 AFSC. These airmen inspect, monitor, troubleshoot, operate,

maintain, and repair missile weapon system support facilities and equipment (similar to FMTs), but are generally qualified in a greater number and variety of tasks than are members of an FMT (3:19).

The discussion of these five teams should help the reader more fully appreciate the nature of the maintenance production function and the way the two maintenance squadrons are organized to carry out that mission.

Organizational Missile Maintenance Squadron. The OMMS provides maintenance teams dedicated to on-site missile maintenance which is often directly related to the alert status of the weapon system. The squadron has a Missile Electrical Branch, a Missile Mechanical Branch, and (when assigned) a Transient Alert Branch.

The Missile Electrical Branch is comprised of EMTs who are responsible for targeting and alignment of missiles, repair of electronic, surveillance, electrical, and access system components at LCFs and LFs. The Missile Mechanical Branch removes, transports, and installs missiles, reentry vehicles and systems, propulsion system rocket engines, Emergency Rocket Communications Systems, and penetration aid sections. Personnel from the MHT and MMT sections perform these tasks. When assigned, the Transient Aircraft Branch provides ground handling and servicing of transient aircraft.

Field Missile Maintenance Squadron. Three primary sections combine to form the FMMS: Shop Maintenance, Facility Maintenance, and Vehicle and Equipment Control branches. (When authorized, a Precision Measurement Equipment Laboratory (PMEL) and a Reentry Vehicle Branch are additionally assigned). The FMMS performs both organizational and intermediate level maintenance either by: (1) "on-equipment" specialists or maintenance teams, or (2) "in-shop" maintenance.

The Shop Maintenance Branch consists of three shops: the Mechanical, Power-Refrigeration-Electric, and the Electronics Laboratory. The Mechanical Shop operates and maintains selected test facilities and provides in-shop maintenance on weapon system unique vehicles and equipment. The Power-Refrigeration-Electric Shop provides in-shop maintenance for their respective specialties. The Electronics Laboratory

> . . . is responsible for the checkout, inspection, calibration, and repair of electronic systems components of the missile associated aerospace ground equipment. The electronics laboratory operates and maintains electronic test equipment and performs bench checks and the repair of electronic components removed from the missile sites. All of the on-base build-up actions required on the missile guidance set are performed by the electronics laboratory. (25:18)

Technicians from these shops may be called upon to augment maintenance teams in the event that the discrepancy/malfunction calls for their particular specialty.

The Facility Maintenance Branch contains four sections: Facility Maintenance Team, Periodic Maintenance Team (both of which were previously described), Pneudraulics, and Corrosion Control. The Pneudraulics Section is responsible for providing both in-shop and on-site maintenance support on hydraulic and pneumatic systems and the associated test equipment (25:20). As implied by its name, the Corrosion Control Section performs preventive and corrective treatment (painting) to the LF and LCF facilities.

The Vehicle and Equipment Control Branch (VECB) is responsible for providing vehicles to support maintenance dispatch requirements, controlling and issuing equipment to maintenance teams dispatching to LFs or LCFs, and controlling, maintaining, and issuing technical orders for use by both of the missile maintenance squadrons.

The PMEL Branch (when assigned) maintains, calibrates, and certifies specified test equipment. The Reentry Vehicle Branch (when assigned) maintains reentry vehicle warheads and associated handling and test equipment (9:17).

These technicians collectively perform the maintenance complex's vital and demanding role of supporting the wing's SIOP responsibility. Their daily contact with the Minuteman weapon system and their particular expertise in the system's strengths and weaknesses gives them unique insight on matters of morale and job satisfaction and,

ultimately, on the overall reliability of this highly strategic component in the U.S. arsenal of deterrence.

Summary

This chapter highlighted the behavioral science approach to work redesign by examining several theories of worker motivation (both process and content) and also provided some insight into the Minuteman concept as it currently exists at six Strategic Air Command bases.

Air Force regulation dictates that "the key to successful maintenance production is a stable, weapon system experienced maintenance workforce" (49:10). It further states that

> Air Force specialties should be designed to emphasize maximum productivity of limited resources through job enlargement by making skills weapon system specific rather than subsystem specific. This will enable the development of a manpower base responsive to future force requirements and to economic and demographic realities. (49:10)

Thus, understanding the linkage between theory and policy (as presented in this chapter) is extremely helpful to the reader as the study progresses to the methodology.

# III. Methodology

This chapter presents the plan and methods used to conduct the research for this study. Topics of discussion include the respondents (whose inputs became the source of the data base), the survey instrument, the specific diagnostic plan, and the tools of analysis utilized to measure the relationships between the workers' perceptions of their jobs and selected attitudes which are present. The actual task characteristics measured and analyzed are those described by Hackman and Oldham in their job characteristics model of work motivation. Other specific areas of analysis include the overall potential of a job to encourage internal work motivation on the part of job incumbents (as measured by the motivating potential scores), the extent to which missile maintenance technicians are satisfied with their work (context satisfactions), and finally, the workers' perceptions of what aspects, if any, are in need of change. Several assumptions which condition the methodology used in this research close out this chapter.

## Study Group and Administration of Surveys

The study population is comprised of only enlisted maintenance technicians who perform duty within a SAC

Minuteman Missile Wing Organizational Missile Maintenance Squadron (OMMS), Field Missile Maintenance Squadron (FMMS), or Strategic Missile Wing maintenance staff division and assigned to one of the selected career fields. In this manner, administrative personnel who are assigned to the missile squadrons and wing (but who do not directly participate in such tasks as removal and replacement, repair, inspection, servicing or calibration of components and end items), are excluded from this research.

Although the scope of this report encompasses the six Minuteman Strategic Missile Wings exclusively, it is the author's assertion that the absence of data from maintenance personnel assigned to the one remaining fully operational Titan II missile wing (Little Rock AFB, Arkansas) and those assigned to the three activated GLCM units overseas (Greenham Common, United Kingdom; Comiso, Italy; and Florennes, Belgium) does not adversely impact the procedural design of this study.

Additionally, surveys were administered only to individuals from the selected AFSCs who had attained a three, five, or seven skill level. A skill level is translated to indicate "the degree of competence an individual has achieved with respect to the duties and responsibilities associated with an Air Force Specialty (AFS)" (3:14). Progression through the skill levels (refer to Table 2) is accomplished through a logical set of steps including

TABLE 2

AIR FORCE SKILL LEVELS AND CAREER POSITIONS (3:15)

| Skill Level | Career Position |
|---|---|
| 1 | Trainee |
| 3 | Apprentice |
| 5 | Journeyman |
| 7 | Supervisor/Technician |
| 9 | Superintendent |

formal technical training, on-the-job training (OJT), and completion of the AFS specific Career Development Course (CDC). Designed for specific skill levels within a career field, CDCs contain study materials relating to the technical aspects of a technician's functional work area. The award of a three skill level is bestowed upon those enlisted personnel who graduate from the technical training course at Chanute AFB, Illinois. Technicians subsequently earn the five skill level by successfully completing the CDC for their assigned specialty, completing applicable OJT requirements, and obtaining the recommendation of their supervisor (3:14).

By limiting the sample population to those airmen and noncommissioned officers (NCOs) who possess a three, five, or seven skill level, the data should more accurately depict the perceptions of those technicians who actually

perform (rather than strictly supervise) the tasks which directly relate to the focus of this study. From an estimated population of 2275 three, five, and seven level technicians, two hundred individuals from each of the three identified AFSCs were randomly selected by means of an Atlas search--a computer search technique which selects Air Force members meeting specific criteria from an existing personnel data base. Next, survey packages were distributed to selectees by name through their parent organizations. The package consisted of a cover letter, complete with instructions, the survey itself (contained in Appendix C), and a preaddressed return envelope. The overall response rate and selected AFSC response rates are listed in Table 3. The total percentage of 52.3 is very near the anticipated 55 percent mark (based on the author's discussions with faculty and advisors at AFIT); therefore, the response rates are considered adequate for this research project.

## The Survey Instrument

The questionnaire used to collect data for this study is called the Perceived Job Characteristics and Attitude Questionnaire and is composed of two parts: (1) the short form of the Job Diagnostic Survey (19) which was designed to measure relevant variables in the job characteristics theory; and (2) a brief set of questions designed

TABLE 3

SURVEY RESPONSE RATES

| AFSC | Number Sent | Returned Usable* | Return Rate |
|---|---|---|---|
| 411X0 | 200 | 108 | 54.0 |
| 411X1 | 200 | 117 | 58.5 |
| 411X2 | 200 | 89 | 44.5 |
| Total | 600 | 314 | 52.3 |

*Note: The actual response rate was slightly higher than indicated; however, four surveys were excluded from the sample returns due to "gaming" (i.e., respondent answered all questions with a "1") or failing to answer all six sections of the questionnaire.

to provide demographic characteristics of the survey population. Each equestion is designed to measure a personal, affective reaction or feeling that an individual obtains from performing his or her job. The data provided by the first part of the questionnaire, however, is subject to more robust testing and analysis than is a portion of the demographic data, whose existence serves to provide a baseline for further research conducted in the field of maintenance.

The Job Diagnostic Survey (JDS)

The JDS is intended to diagnose existing jobs to determine if (and how) they could be redesigned in an effort to enhance employee motivation and productivity (19:59). Its importance in this study is paralleled by

that of the job characteristics model itself and warrants, therefore, a thorough description. The JDS was first described by Hackman and Oldham in 1974, although its origins lie in previous methodologies developed earlier by Turner and Lawrence in Industrial Jobs and the Worker (45) and Hackman and Lawler in a Journal of Applied Psychology Monograph (16). A significant number of the scales and items used in these prior studies have been revised and now appear in the JDS. The JDS itself took two years and three major revisions, and was taken by over 1500 individuals working on more than 100 different jobs, before it appeared in its present form (19:161). Two forms of the JDS have surfaced: the JDS and the JDS Short Form. The JDS Short Form was chosen to administer in this study for three reasons. First, this instrument contains the same scales and measures the same objective job dimensions as the JDS, while containing fewer items, and thus requiring less time to complete by its recipients. Second, scoring procedures for the Short Form are readily available (note Appendix D). Third, the psychological states theorized (experienced meaningfulness of the work, experienced responsibility of the work outcome, and knowledge of results) by the model as mediating between the core job dimensions and the outcomes of the work are not, in and of themselves, measured by the Short Form. Because they are

not the subject of any direct hypotheses presented in this report, their inclusion is not considered to be necessary.

Relevant Concepts Measured by the JDS

The JDS provides measures of the five core dimensions, presented in Figure 1 (Chapter II), which serve as key variables in this study. In addition to skill variety, task identity, task significance, autonomy, and feedback from the job itself, two additional job dimensions are measured by the JDS, including (19:162):

1. Feedback from agents. The degree to which the employee receives clear information about his or her performance from supervisors or from co-workers. (This dimension is not, strictly speaking, a characteristic of the job itself. It is included to provide information to supplement that provided by the "feedback from the job itself" dimension.)

2. Dealing with others. The degree to which the job requires the employee to work closely with other people in carrying out the work activities (including dealings with other organizational members and with external organizational "clients").

Scores on the job dimensions are collected from questions in two sections of the JDS. In the first section, employees mark on the seven-point scale the relative amount

of each job characteristic present (in their perception) in the work they perform. In the second section, employees express the accuracy of a collection of statements about the characteristics of their job (19:162).

Additionally, the JDS measures a number of personal outcomes that workers experience from carrying out their duties. These outcomes are affective reactions or feelings an employee develops rather than direct measures of actual work outcomes (such as productivity). These personal outcomes or "rewards" are measured in terms of (19:162):

1. General satisfaction. An overall measure of the degree to which the employee is satisfied and happy with his job.

2. Internal work motivation. The degree to which the employee is self-motivated to perform effectively on the job--that is, the employee experiences positive internal feelings when working effectively on the job, and negative internal feelings when doing poorly.

3. Specific satisfactions. A number of short scales provide separate measures of satisfaction with:

   a. growth satisfaction--the opportunity for personal growth and development on the job;
   b. job security;
   c. social satisfaction--includes peers and co-workers;

d. pay and other compensation; and

e. supervision.

Items measuring the first two affective reactions listed are intermixed with items investigating the three critical psychological traits (in the long form only). For the five specific satisfactions listed, employees directly report whether they are satisfied or dissatisfied with their jobs.

Finally, the JDS taps the strength of the employee's growth need from his or her work. This observation is predicted to influence how positively an employee will respond to a job which exhibits objectively high motivating potential (19:163).

Applications of the job characteristics theory allow a researcher to compute the motivating potential score (MPS) of a job expressed in terms of the five core job dimensions discussed earlier. The MPS, then, may be thought of as "a single summary index of the degree to which objective characteristics of the job will prompt internal work motivation" (20:59).

Development of the JDS

The JDS has been the most widely used questionnaire in task design research, and there exists a substantive body of information regarding its development, reliability, and validity. Results originally reported in the test of the theory by Hackman and Oldham were based on 658 employees

working on 62 different jobs in 7 organizations. The jobs spanned a wide spectrum, from blue-collar to professional work; organizations likewise ranged from industrial to service settings. Geographically, respondents were polled from the east, southeast, and midwest positions of the U.S. in both rural and urban settings. Participation was entirely optional and confidentiality guaranteed.

Internal consistency reliabilities ranged from a high of .88 (growth need strength) to a low of .56 (social satisfaction). The median off-diagonal correlations (one indication of the discriminant validity of the items) ranged from .12 (task identity) to .28 (growth satisfaction). Overall, the results suggested "that both the internal consistency reliability of the scales and the discriminant validity of the items are satisfactory" (19:164). A detailed presentation of the substantive validity of the JDS is presented in Development of the Job Diagnostic Survey by J. Richard Hackman and Greg R. Oldham (19), a discussion of which appears in Appendix E of this report.

Diagnostic Use of the JDS

As a data collection instrument, the JDS is extremely useful in diagnosing existing jobs prior to work design, as one input of a multi-method analysis regarding whether and how redesign should proceed (17:103). This study's aim is to interpret the JDS responses using the

analysis format provided in the next section to identify any jobs and/or environmental conditions (intrinsic and/or extrinsic factors) which might contribute to substandard individual motivation and job satisfaction. Thus, any indication of potential need for work redesign or policy change recommended at the conclusion of this research has its basis in the information obtained from this data. In this manner, any preexisting bias on the part of the author should be minimized.

Hackman and Oldham present a framework of the specific methodology they used in the test of their theory of job characteristics in Work Redesign (17). This framework consists of a sequential analysis plan and investigation of the JDS scores for each theory variable to establish their usefulness in making each diagnostic determination (15:83). This plan, which consists of five questions (as modified), is used by the author to diagnose existing missile maintenance jobs with respect to the possibility of task redesign. Table 4 contains a summary of the five key questions which undergird this methodology.

To further strengthen the understanding of this specific method used in this study, a flow chart of the diagnostic plan is illustrated in Figure 3 (15:83). A dicussion follows which serves to relate the construct of the questionnaire administered to the diagnostic activities as presented.

TABLE 4

SUMMARY OF FIVE QUESTIONS TO ASK IN DIAGNOSING WORK SYSTEMS PRIOR TO WORK REDESIGN (17:128)

| |
|---|
| Assessing the need for work redesign |
| 1. Is there a problem or an exploitable opportunity? |
| 2. Does the problem or opportunity centrally involve employee motivation, satisfaction, or work effectiveness? |
| 3. Might the design of work be responsible for the observed problems? |
| 4. What aspects of the job most need improvement? |
| Determining the feasibility of work redesign |
| 5. How ready are the employees ready for change? |

Step 1. Are motivation and satisfaction potential problem areas in SAC Minuteman missile maintenance units? In the past, the literature relates several instances in which unwarranted work redesign programs have been initiated by managers who exhibited more zeal than actual understanding of their organizations' problems. The mid-1970s, in particular, was a time that saw organizations "jumping on the job-enrichment bandwagon" with results, as might be expected, turning out less than optimal. According to Hackman and Oldham, "If work design is to be implemented only because someone says it should be, failure is just around the corner" (17:110). The JDS is a readily available diagnostic tool that reduces the risks of

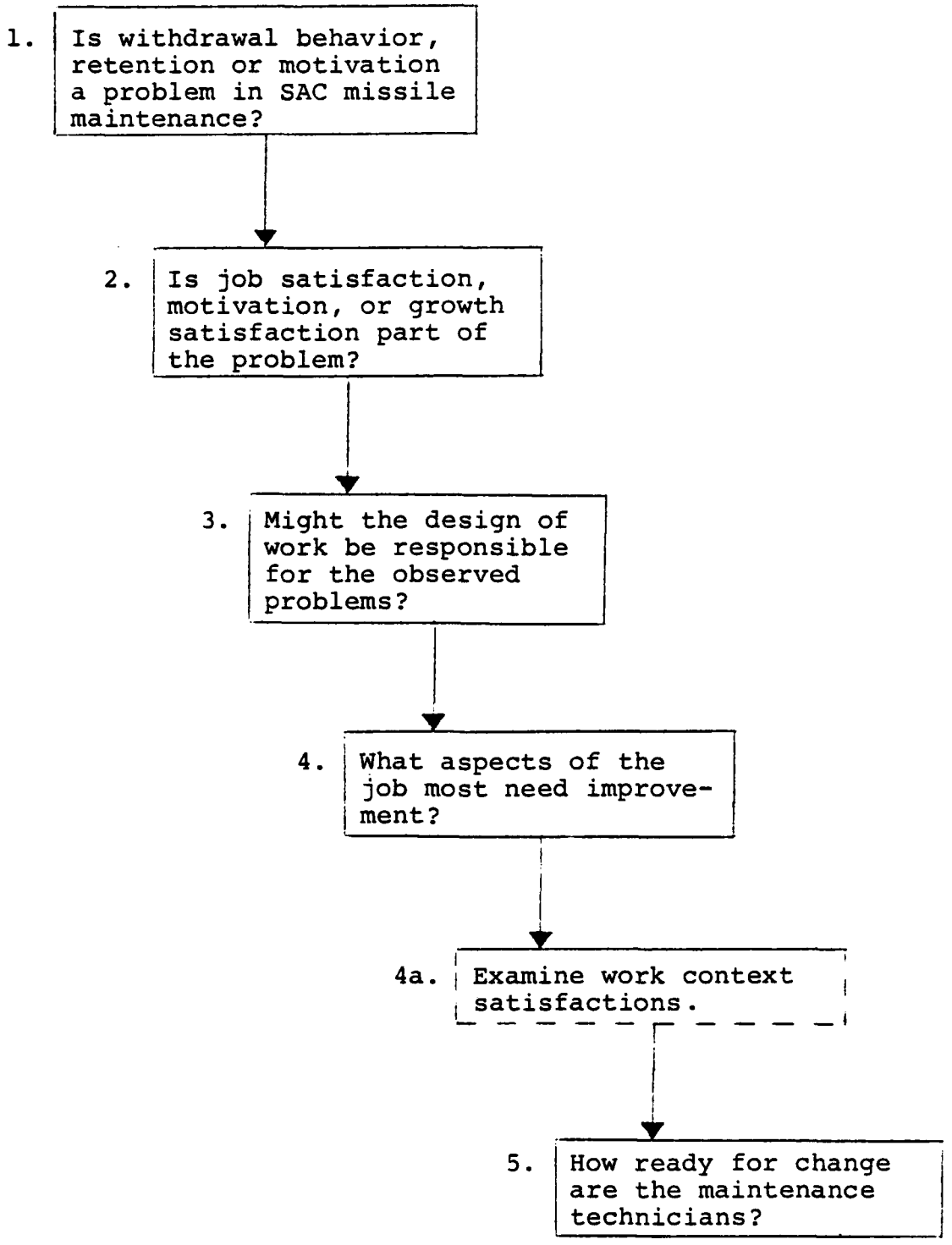



Fig. 3. Sequential Diagnostic Plan (10:58)

intuition with respect to job design and may be used to make a determination of the real cause of an organization's inability to meet its goals. Based on conversations with Air Force Human Resources Laboratory (AFHRL) personnel (4) and the underlying assumption presented in a 1984 report concerning the missile maintenance environment "that maintenance organizations have problems" (5:2) and "that, in studying Air Force maintenance as a whole, problems will surface which can be solved . . . through policy changes," (5:12) the author proposes that the administration of the JDS to Minuteman missile units is justifiable. The information from the data provided was used to answer the remaining questions in diagnosing work systems prior to work redesign.

Step 2. Does the problem centrally involve job satisfaction, motivation or growth satisfaction? In this application, JDS scores on internal work motivation, general satisfaction, and growth satisfaction were collected for each AFSC and compared to one another and to baseline normative scores provided by Hackman, Oldham, and Stepina for nonmanagerial job families (presented in Appendix E). Deviations from the established norms in the negative direction could indicate that motivation and satisfaction are specific problem areas (15:18).

Step 3. Determine whether the design of work might be responsible for the observed problems. Researchers have determined that

> . . . work redesign is an appropriate change strategy only if there is reason to believe that observed problems may have their roots in the motivational properties of the work itself (17:111)

or from the work environment. To help make this assessment, the motivating potential score (MPS) provided by the JDS of each of the surveyed AFSCs is compared with one another and with the national norms. If MPS is low, then it appears reasonable to conclude that the work itself may be contributing to the organizational and attitudinal problems previously documented; if MPS is high, it then would be reasonable to inspect other aspects of the work environment (for example, supervision, co-worker relations, or pay as tapped by the JDS) as potential causes of the observed shortcomings (17:111). Again, if the responses of technicians indicate an MPS near or below the national averages for these scales, then it is appropriate to proceed to the diagnostic step described next.

Step 4. What aspects of the job most need improvement? According to Hackman and Oldham,

> It is not enough to know that a job is low in motivating potential (as determined by the MPS). Researchers also must identify what it is about the job that most needs to be improved. (17:115)

To accurately identify these specific weaknesses of a job, this research examines the job in terms of the five core

dimensions described in the model. Utilizing the seven-point scales and computed MPS scores, job profiles are constructed to emphasize areas where improvement would be most beneficial. Illustrated job profiles identified as "ideally" enriched, "normally" enriched, or "poorly" enriched are depicted in Figure 4 (15:86). Accomplishment of this step includes both hypothesis testing as described in the above steps and correlation analysis to help prioritize the core job dimensions as an aid in adapting an effective job redesign program to a particular career field (10:63).

Once the above four questions have been tested, Hackman and Oldham postulate that, "it should be clear whether work design is a sensible change strategy for the organization under study" (17:115). When this is the case, the focus of the diagnosis shifts from whether change is needed to whether it is feasible to actually carry out the necessary changes in the target jobs.

Prior to examining this feasibility, several context satisfaction indicators (such as pay, supervision, and co-worker relationships) measured by the JDS are tested to help present a more complete picture of the work environment. The significance of these contextual variables is that when problems exist in these areas, the employee may be unable to exploit opportunities for growth and personal development in the job (10:63).

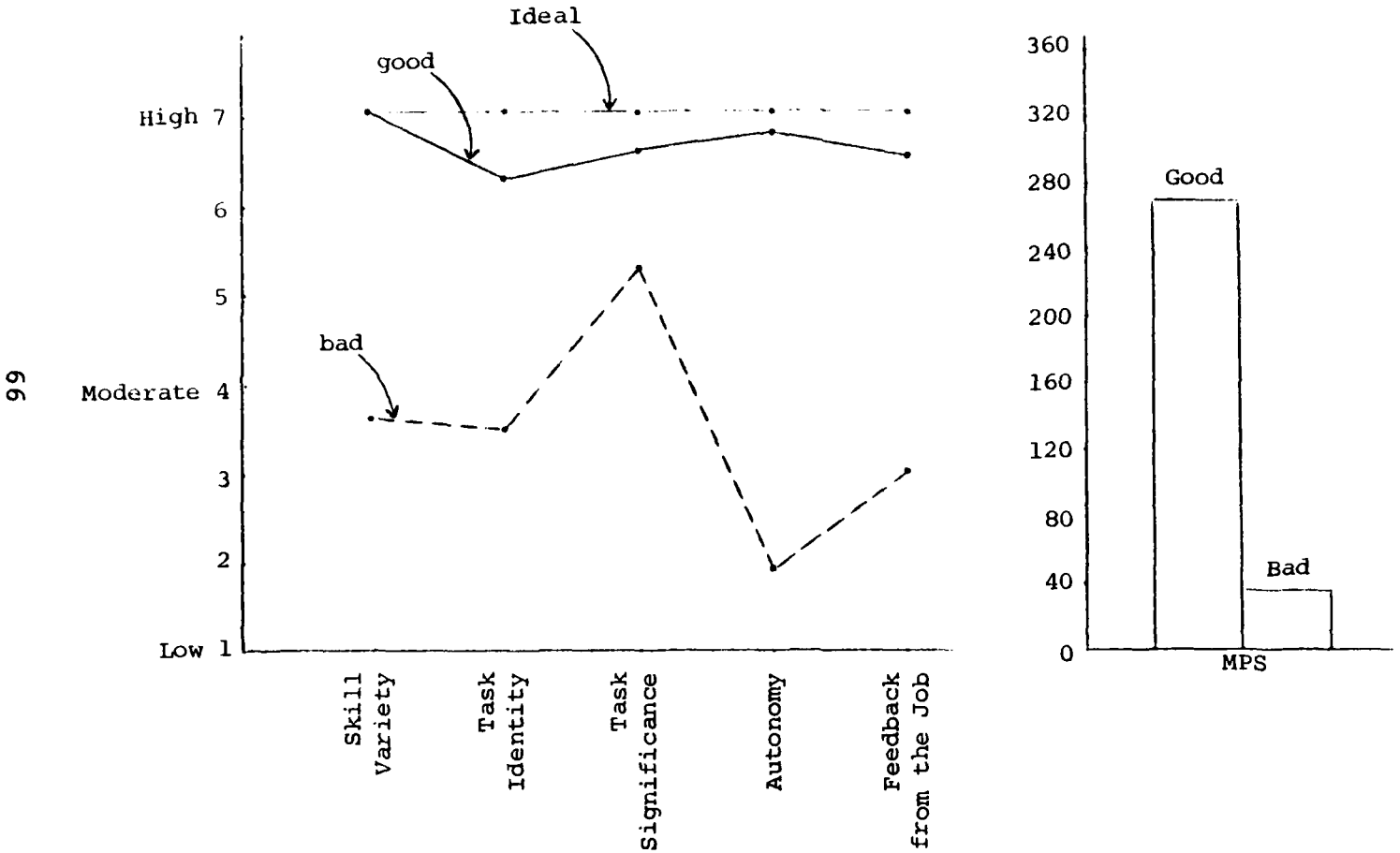



Fig. 4. JDS Profile of a "Good" and a "Bad" Job

Step 5. Are the workers willing to support a job redesign program? Regardless of the diagnostic outcome and redesign plan of the researcher, analysis must include the relative degree of the employees' "readiness" for change. JDS responses which tap this attitude are those measures which identify employee growth needs. Employee receptiveness to work redesign has been found to vary directly with perceived growth needs in a significant number of studies to support this link in the theory. Thus, an evaluation of the extent, timetable, and method associated with a job enrichment program may be determined by the magnitude of the growth need strength measure.

## Statistical Analysis

Following the sequential diagnostic plan presented in the previous section, this discussion specifies the statistical tools utilized to determine whether the samples drawn from the population differ from one another in a statistically significant (or insignificant) manner. The statistical textbooks and previous research papers present a plethora of analytic methods to investigate data on job satisfaction; the author has selected two of these methods, large-sample hypothesis testing about the difference between two population means and correlation analysis, to answer the investigative questions. Actual analysis of the data was performed using the Statistical Package for

the Social Sciences (SPSS) program (update 9) developed by Northwestern University. SPSS routines used for this study were:

1. FREQUENCIES
2. Pearson Correlation (PEARSON CORR)

Large Sample Difference of Means. The SPSS FREQUENCIES routine was used to compile statistics to provide the distribution of responses and to analyze the significance of deviations within and between the various subgroupings. The FREQUENCIES routine provided the following information for each category:

1. mean
2. median
3. mode
4. standard deviation
5. variance
6. minimum and maximum values
7. number of actual responses

Sample means and standard deviations were the selected parameters used in the testing of hypotheses. In this manner, the sequential diagnostic plan was followed and each of steps one through five was evaluated in an effort to answer the investigative questions. The systematic approach used by the author to test each hypothesis during

the data analysis (contained in Chapter IV) is as follows (10:65).

1. Using SPSS, compute sample mean and standard deviation of the key variable being tested using SPSS.

2. State both a null hypothesis ($H_o$) and an alternative hypothesis ($H_a$) in the following form:

$$H_o: \ \mu_1 = \mu_2$$

$$H_a: \ \mu_1 \neq \mu_2, \text{ or } \mu_1 > \mu_2, \text{ or } \mu_1 < \mu_2$$

The null hypothesis, in all cases, was stated such that the two sample means were assumed to be the same.

3. Specify a significance level for the test. In cases where the alternative hypothesis was stated to reflect a positive or negative relationship between the means being tested, the tests were one-tail tests with a chosen significance level of $\alpha = .05$. This resulted in a critical z-value of 1.645. In cases where the alternative hypothesis was stated as $\mu_1 \neq \mu_2$, the tests were two-tail tests with a significance level again set at $\alpha = .05$. The critical z-value in these instances is 1.960. The significance level is the smallest probability that the test statistic will erroneously reject the null hypothesis. The author, therefore, is reasonably confident that this statistical test has led to a correct conclusion.

4. Compute the standard deviation of the sampling distribution using the following formula:

$$\sigma_{(\bar{x}_1 - \bar{x}_2)} = \sqrt{\frac{(s_1)^2}{n_1} + \frac{(s_2)^2}{n_2}}$$

Since the sample size, n, was greater than 30 in all cases, the computed value of the sample variances, $s_1^2$ and $s_2^2$ were assumed to provide good approximations to $\sigma_1^2$ and $\sigma_2^2$ (the population variances).

5. Compute the test statistic (z-statistic is appropriate due to the size of sample) using the following formula:

$$z = \frac{(\bar{x}_1 - \bar{x}_2) - D_o}{\sigma_{(\bar{x}_1 - \bar{x}_2)}}$$

where $D_o$ (the hypothesized difference between the means) is zero.

6. Compare the test statistic with the previously determined critical value for z, to ascertain whether a significant difference between populations means actually exists.

A more comprehensive discussion of hypothesis testing and the mechanics of the z-statistic is presented in Statistics for Business and Economics (Second Edition) (30:282-292). The samples drawn from the population in

this research were independent. At each step of the methodology, sample means were determined from the stratified population and manually compared to normative data reported by Hackman, Oldham, and Stepina and to the other two AFSCs.

McClave and Benson (30:329) discuss three assumptions relevant to large-sample inferences about the difference between two population means which are applicable to this analysis (10:67):

1. The samples are randomly selected in an independent manner from the studied populations.

2. The sample sizes, $n_1$ and $n_2$, are large enough so that $\bar{x}_1$ and $\bar{x}_2$ each have approximately normal sampling distributions and so that $s_1^2$ and $s_2^2$ provide good approximations to $\sigma_1^2$ and $\sigma_2^2$.

3. The sampling distribution of $(\bar{x}_1 - \bar{x}_2)$ is approximately normal for large samples.

Correlation Analysis. The second statistical method used in this research to identify the variables which are associated with and may exert influence on job satisfaction with respect to the selected AFSCs is correlation analysis. The term correlation implies a relationship between two variables (30:418); the type of correlation used in the statistical analysis at step 4 of the diagnostic plan was the Pearson Product Moment Coefficient

of Correlation, "r." Pearson's r, which was computed using the PEARSON CORR routine of SPSS, is thus a measure of association indicating the relative strength of the linear relationship between two variables (for example, task significance and internal motivation). The correlation coefficient r is scaleless; if its value is close to zero, the researcher may assume that little or no linear relationship exists between the two variables under consideration. If, however, the value of r approaches +1.0 or -1.0, the researcher can assume that there is a strong linear relationship (33:279). The PEARSON CORR subprogram computes zero-order correlations (no controls for the partial influence of other variables are made) and is used extensively to measure relationships between interval-level variables.

Assumptions

Based on the previous research of Air Force maintenance units by Guthrie (15) and Flynn (10), the methodology used in this study to diagnose jobs provides a validated plan to recognize statistically significant motivational characteristics. Further, the JDS is less appropriate for upper-level managers, whose jobs entail role relationships which remove them from the concrete tasks performed by technicians at lower levels. Thus it is assumed that the three, five, and seven skill level

maintenance population sampled adequately reflects the perceptions of those workers whose jobs have the most potential for redesign. A final assumption is that the guarantee of anonymity explained in the cover letter of the survey resulted in sample responses which were unbiased.

# IV. Findings

## Introduction

The findings of the sample survey and associated analyses are presented in this chapter in six sections. This research endeavored to investigate both the degree to which missile maintenance technicians perceive their jobs as satisfying their needs and expectations as well as the degree of job satisfaction they perceived on the five core dimensions theorized by Hackman and Oldham as being fundamental to job satisfaction. The underlying purpose was to ascertain whether or not a job redesign strategy (such as job enrichment) would be justified as a method to increase individual job satisfaction.

The first section displays the demographic data of respondents in a tabular format. Next, the perceived affective work outcomes are analyzed to better understand how technicians feel about performing their jobs. This is followed by an analysis to determine whether or not the jobs are low in motivating potential. The fourth section is of critical importance to this study, for it seeks to answer which aspects of the jobs (if any) are associated with the perceived difficulties. The fifth section incorporates a statistical analysis of the work context

(hygiene) factors to help establish whether the work itself or the work environment contributed to perceived job dissatisfaction. The final section reports the readiness of respondents to the introduction of changes in their jobs. The findings presented in this chapter provide the basis for any conclusions drawn by this report regarding the applicability of work redesign among missile maintenance specialists.

Step One: Demographic Characteristics

Prior to any statistical analyses being performed on the attitudes of the respondents, a review of the demographic data was accomplished to determine whether or not the characteristics of the subgroups under study deviated extensively from one another. A demographic representation of those technicians who responded to the survey appears in Table 5.

Of the demographics generated, several variables deserved comment. Concerning technicians' present organization (Item A of Table 5), two trends were evident: first, a rather small percentage (11 percent) of the Systems Analyst Specialists (AFSC 411X0) worked in the FMMS; and second, an even smaller percentage (1 percent) of the Facilities Maintenance Specialists (AFSC 411X2) worked in the OMMS. Recalling the discussion in Chapter II, the author contends that since overlapping exists between the

TABLE 5

MISSILE TECHNICIAN CHARACTERISTICS*

| A. Present Organization | OMMS Qty(%) | FMMS Qty(%) | Other Qty(%) | Total Qty(%) |
|---|---|---|---|---|
| 411X0 | 45(42) | 12(11) | 51(47) | 108(100) |
| 411X1 | 46(39) | 35(30) | 36(31) | 117(100) |
| 411X2 | 1(01) | 64(72) | 24(27) | 89(100) |
| Total | 92(30) | 111(35) | 111(35) | 314(100) |

| B. Vehicle Branch Member | Yes Qty(%) | No Qty(%) | Total Qty(%) |
|---|---|---|---|
| 411X0 | 5(05) | 103(95) | 108(100) |
| 411X1 | 21(18) | 96(82) | 117(100) |
| 411X2 | 8(09) | 81(91) | 89(100) |
| Total | 34(11) | 280(89) | 314(100) |

| C. Skill Level | 3 Lvl Qty(%) | 5 Lvl Qty(%) | 7 Lvl Qty(%) | Total Qty(%) |
|---|---|---|---|---|
| 411X0 | 7(07) | 53(49) | 48(44) | 108(100) |
| 411X1 | 14(12) | 56(48) | 47(40) | 117(100) |
| 411X2 | 8(09) | 42(47) | 39(44) | 89(100) |
| Total | 29(09) | 151(48) | 134(43) | 314(100) |

Note: *Raw numbers appear first in the tabulated data; percentages (in parentheses) follow.

TABLE 5--Continued

| D. Present Active Duty Rank | 411X0 Qty(%) | 411X1 Qty(%) | 411X2 Qty(%) | Total Qty(%) |
|---|---|---|---|---|
| AIC | 8(07) | 14(12) | 4(04) | 26(08) |
| SRA | 13(12) | 19(16) | 19(21) | 51(16) |
| SGT | 33(31) | 27(23) | 24(27) | 84(27) |
| SSGT | 27(25) | 35(30) | 31(35) | 93(30) |
| TSGT | 22(20) | 13(11) | 7(08) | 42(13) |
| MSGT | 5(05) | 9(08) | 4(06) | 18(06) |
| Total | 108 | 117 | 89 | 314 |

| E. Missile Maintenance Experience Only | Yes Qty(%) | No Qty(%) | Total Qty(%) |
|---|---|---|---|
| 411X0 | 86(80) | 22(20) | 108(100) |
| 411X1 | 105(90) | 12(10) | 117(100) |
| 411X2 | 70(79) | 19(21) | 89(100) |
| Total | 261(83) | 53(17) | 314(100) |

| F. Supervisory Status | Yes Qty(%) | No Qty(%) | Total Qty(%) |
|---|---|---|---|
| 411X0 | 59(55) | 49(45) | 108(100) |
| 411X1 | 63(54) | 54(46) | 117(100) |
| 411X2 | 54(61) | 35(39) | 89(100) |
| Total | 176(56) | 138(44) | 314(100) |

TABLE 5--Continued

| G. Number of Subordinates Supervised | 411X0 Qty(%) | 411X1 Qty(%) | 411X2 Qty(%) | Total Qty(%) |
|---|---|---|---|---|
| None | 49(45) | 54(46) | 35(39) | 138(44) |
| Less than 5 | 45(42) | 42(36) | 36(41) | 123(39) |
| 5 to 11 | 8(07) | 10(09) | 10(11) | 29(09) |
| 11 to 15 | 4(04) | 1(01) | 1(01) | 6(02) |
| More than 15 | 2(02) | 10(08) | 7(08) | 19(06) |
| Total | 108(100) | 117(100) | 89(100) | 314(100) |

squadrons (FMMS personnel perform both intermediate level and organizational level maintenance), this disparity is not considered significant. This overlapping is somewhat unevenly distributed among the two maintenance squadrons since specialists from the shops (FMMS personnel) augment those teams dispatching to the missile site (often these are OMMS personnel) in the event that the discrepancy or malfunction demands their particular expertise.

Next, based on comments and suggestions made by earlier researchers (5; 4), the author sought to determine the relative contribution of the Vehicle and Equipment Control Branch respondents (Item B of Table 5) to the overall pool of maintenance specialists surveyed. The implication presented was that since these technicians oftentimes do not directly use those skills imparted to them from their technical training courses, their overall job satisfaction would likely be lower than the other maintenance branches. The low (10.8 percent) contingent of VECB personnel in the sample represented all three AFSCs, the majority of which came from the Missile Maintenance Specialists (AFSC 411X1). This was not considered to adversely impact the balance among the subgroups.

The average technician surveyed had achieved a skill level of five and was either an E-4 (Sergeant) or E-5 (Staff Sergeant). The vast majority of respondents had worked in missile maintenance for the duration of their

Air Force careers. And while over half of those surveyed were engaged in some aspect of supervision, these technicians were likely to have four or less subordinates. Overall, the author surmised that the three AFSCs were evenly matched for comparative purposes and that the more rigorous analysis that follows was justifiable.

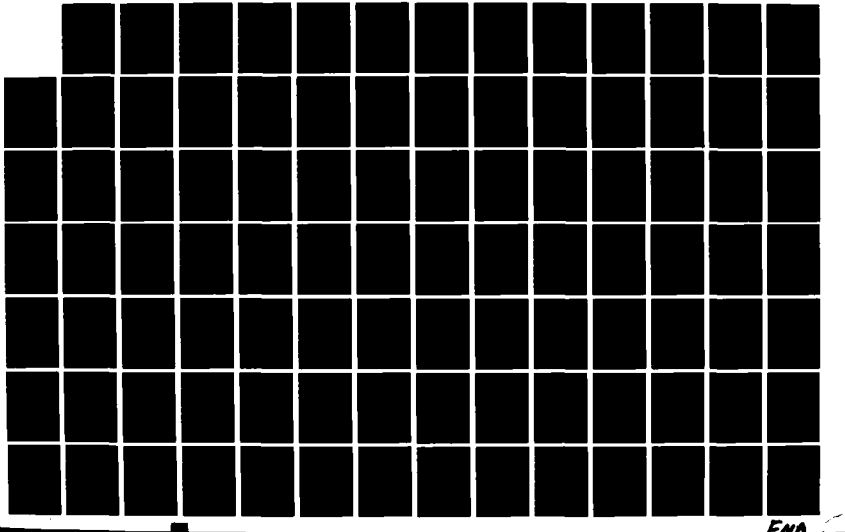
## Step Two: Analysis of the Perceived Affective Work Outcomes

This step compares three separate work outcomes of the selected AFSCs to the national norm and to each other. The outcomes include job satisfaction, internal work motivation, and growth satisfaction. The significance level for all hypothesis testing (both one-tail and two-tail) was chosen as $\alpha = .05$.

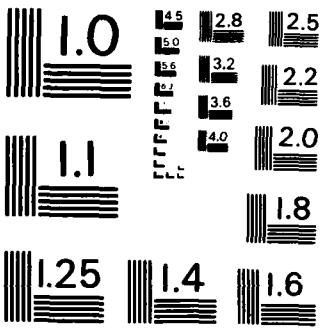
Job Satisfaction. According to a study by Katz and Kahn, research indicates that even though favorable job satisfaction may not inspire high productivity, per se, there are other beneficial effects. Favorable employee attitudes are associated with a lower rate of personnel turnover and less absenteeism (28:437). In view of this fact, job satisfaction could significantly affect mission accomplishment in an Air Force missile wing. A high rate of turnover, for example, tends to increase recruitment and training burdens. In this instance, "turnover" implies separation from military service whereby a trained,

AD-A161 685 AN APPLICATION OF THE JOB CHARACTERISTICS MODEL TO ENLISTED STRATEGIC AIR.. (U) AIR FORCE INST OF TECH WRIGHT-PATTERSON AFB OH SCHOOL OF SYST.. C J PRICE

UNCLASSIFIED SEP 85 AFIT/GLM/LSMA/85S-65 F/G 5/9 NL



END



mission-ready technician is lost from the available manpower pool. It is also probable that a high morale level represents a "plus" in terms of public relations. A favorable public attitude encourages the best applicants to apply, and this is particularly significant in times of short labor supply, as is anticipated in the 1990s. No doubt the task of supervision is also less burdensome if job satisfaction is high. A commander, therefore, has a number of reasons for assessing the overall attitudes of his troops and for taking initiatives to promote positive affective work outcomes (28:437).

The first hypothesis is stated in the null form (see Appendix B for an expanded version of the hypotheses tested in this chapter):

Hypothesis 1: The degree of job satisfaction perceived by enlisted missile maintenance technicians does not differ in the 411X0, 411X1, and 411X2 career fields, and is the same as the national norm.

The sample size, mean job satisfaction score, and standard deviation for each AFSC is shown in Table 6. Additionally, three sets of z-values are presented. The first row of z-values compares each AFSC with the national norm (a table of the national norms used in this study is contained in Appendix E). The second row compares Systems Analyst Specialists with Missile Maintenance Specialists, and Missile Maintenance Specialists with Missile Facilities Specialists. A final comparison, that of Systems Analyst

TABLE 6

JOB SATISFACTION MEAN SCORES BY CAREER FIELD AND COMPARISON ANALYSIS OF SAMPLE MEANS

| AFSC/(N) | Mean/Std Dev | z-values 1 | 2 | 3 |
|---|---|---|---|---|
| 411X0/(108) | 4.65/1.45 | .46 | | |
| | | | -.79 | |
| 411X1/(117) | 4.80/1.41 | 1.53 | | -.77 |
| | | | -.05 | |
| 411X2/(89) | 4.81/1.46 | 1.39 | | |
| Total/(314) | 4.75/1.44 | 1.68 | | |
| Nat'l Norm/(500) | 4.58/1.08 | | | |

Note: No significance existed at the .05 level for one-tail or two-tail tests.

Specialists with Missile Facilities Specialists, appears in the last row (10:83).

Statistical comparison of mean scores indicated that the data support the null hypothesis. Thus, no appreciable difference existed in the average level of job satisfaction for the three AFSCs (collectively and individually) and the national norm as well as no significant difference between the career fields themselves. Based on these results, one may speculate that either the working conditions (hygiene factors) are, in actuality, the major determinants of job satisfaction among the subgroups, or perhaps the work itself (motivators) contributes to job satisfaction to an equal extent in each career field. Before the analytical progression moves on to investigate

these two possibilities (and recalling the suggestion that the degree to which personnel are satisfied with their jobs could exert some influence on retention and turnover), Table 7 presents responses to the demographic variable "career intent."

TABLE 7

CAREER INTENT RESPONSES TO JOB ATTITUDE SURVEYS

| AFSC | Separating Qty(%) | Retiring Qty(%) | Undecided Qty(%) | Staying Qty(%) | Total |
|---|---|---|---|---|---|
| 411X0 | 18(17) | 7(06) | 37(34) | 46(43) | 108 |
| 411X1 | 13(11) | 8(07) | 62(53) | 34(29) | 117 |
| 411X2 | 17(19) | 5(06) | 31(35) | 36(40) | 89 |
| Total | 48(15) | 20(06) | 130(41) | 116(37) | 314 |

When grouped together, those respondents who are either undecided or are intending to separate represent nearly 57 percent of the maintenance technicians. For comparative purposes, data (15:113) based on results of a Quality of Air Force Life Survey for enlisted personnel Air Force-wide shows those who are either undecided or who do not intend to make the Air Force a career represent approximately 44 percent. To more closely associate the role that job satisfaction plays on retention and turnover, regression analyses could be run using "career intent" as a variable. This study, however, does not incorporate

regression analysis as a technique of the methodology. Therefore, no statement may be made concerning the degree to which career intent is problematic; one may merely infer from the data that the career intent among the missile maintenance technicians sampled is relatively lower than Air Force enlisted personnel in aggregate.

Further examination of the responses for those personnel who failed to express a positive career intent (N = 178, excluding those retiring) will be amplified in the concluding chapter. For the purpose of the present discussion, Tables 8 and 9 help focus on the work itself (motivating factors) versus work conditions (hygiene factors) discussion.

The author chose to investigate the job location variable as a hygiene factor in appreciation of the fact that the majority of the Minuteman missiles inhabit the "Northern Tier" region of the continental U.S. and therefore subject the technicians who maintain them to severe working "conditions." Table 9, similar in format to Table 8, indicates responses to the "job location" variable. It is advisable that any decisions based on an extrapolation of the data in Table 9 be postponed or made with great caution, however, as the wording of the survey question introduced some confusion on the part of the respondents. Several of the written answers indicated that the word "location" could have been interpreted as the respondent's

TABLE 8

ROLE OF JOBS ON CAREER INTENT*

Question: Is your present job a major factor in your decision?

| AFSC | Yes Qty(%) | No Qty(%) | N/A | Total |
|---|---|---|---|---|
| 411X0 | 26(24/44) | 33(31/56) | 49 | 108/59 |
| 411X1 | 41(35/49) | 42(36/51) | 34 | 117/83 |
| 411X2 | 24(27/45) | 29(33/55) | 36 | 89/53 |
| Total | 91(29/47) | 104(33/53) | 119 | 314/178 |

Notes:

Several of the respondents checked the "Yes" response and subsequently listed both motivating and hygiene factors in the remarks sections. Thus, these results should be considered somewhat skewed away from a strict interpretation of what Hackman and Oldham call the "work itself" factors.

*Raw numbers appear first; following (in parentheses) are percentages in terms of N = 314 and N = 178, respectively.

TABLE 9

ROLE OF JOB LOCATION ON CAREER INTENT*

Question: Is your present job location a major factor in your decision?

| AFSC | Yes Qty(%) | No Qty(%) | N/A | Total |
|---|---|---|---|---|
| 411X0 | 23(21/39) | 36(33/61) | 49 | 108/59 |
| 411X1 | 27(23/32) | 56(48/68) | 34 | 117/83 |
| 411X2 | 25(28/47) | 28(32/53) | 36 | 89/53 |
| Total | 75(24/38) | 120(38/62) | 119 | 314/178 |

Note: *Raw numbers appear first; following (in parentheses) are percentages in terms of N = 134 and N = 178, respectively.

location within the organizational structure. The term "geographical location" would have yielded a purer result. Other factors which contributed to technicians' attitudes about working conditions are examined in a later section (refer to Step Five).

Internal Work Motivation. Recalling Chapter II, a close association in meaning to internal motivation is Blood's concept of "self-rewarding."

> Self-administered rewards, according to Blood, are both immediate and contingent on behavior; in colloquial terms, extreme positive self-rewarding can be characterized as pride, and extreme negative self-rewarding as shame. (17:72)

The second hypothesis considered is likewise expressed in the null form:

Hypothesis 2: The degree of internal work motivation perceived by enlisted missile maintenance technicians is the same throughout the three career fields and is the same as the national norm.

Table 10 shows the results.

TABLE 10

INTERNAL WORK MOTIVATION MEAN SCORES BY CAREER FIELD AND COMPARISON ANALYSIS OF SAMPLE MEANS

| | | z-values | | |
|---|---|---|---|---|
| AFSC/(N) | Mean/Std Dev | 1 | 2 | 3 |
| 411X0/(108) | 5.49/1.03 | .19 | | |
| | | | .36 | |
| 411X1/(117) | 5.44/1.03 | -.29 | | .54 |
| | | | .21 | |
| 411X2/(89) | 5.41/1.04 | -.52 | | |
| Total/(314) | 5.45/1.03 | .29 | | |
| Nat'l Norm/(500) | 5.47/0.81 | | | |

Note: No significance existed at the .05 level for one-tail or two-tail tests.

Table 10 indicates no differences between the organizations when tested at the .05 significance level and, therefore, no grounds for rejecting the null hypothesis.

Growth Satisfaction. When a job is high in motivating potential, technicians experience enriched opportunities for personal learning and growth at work, and they

admit to finding those opportunities personally satisfying (17:89). This final affective work outcome was tested using an alternative hypothesis stating:

Hypothesis 3: The degree of growth satisfaction perceived by enlisted missile maintenance technicians is the same throughout the three career fields, but is collectively lower than the national norm.

The author based this hypothesis on comments reported in an earlier maintenance study (5) that revealed technicians felt their jobs were overly repetitious and that strict adherence to technical manuals left little room for growth and innovation at work. Table 11 lists the results of this analysis.

TABLE 11

GROWTH SATISFACTION MEAN SCORES BY CAREER FIELD AND COMPARISON ANALYSIS OF SAMPLE MEANS

| | | z-values | | |
|---|---|---|---|---|
| AFSC/(N) | Mean/Std Dev | 1 | 2 | 3 |
| 411X0/(108) | 4.56/1.37 | -.49 | | |
| | | | -.32 | |
| 411X1/(117) | 4.62/1.40 | -.07 | | -1.35 |
| | | | -1.05 | |
| 411X2/(89) | 4.82/1.33 | 1.26 | | |
| Total/(314) | 4.66/1.37 | .32 | | |
| Nat'l Norm/(500) | 4.63/1.19 | | | |

Note: No significance existed at the .05 level for one-tail or two-tail tests.

Table 11 indicates that while both the Systems Analyst (411X0) and Missile Maintenance (411X1) specialists report growth satisfactions below the national norm, neither of these subgroups contributes to any significant difference in the testing of this construct. The Facilities Maintenance Specialists, in fact, showed an above average growth satisfaction; however, this was again not a significant level. Thus, there is insufficient evidence to reject the null hypothesis.

Summary. Thus, examination of the motivation and job satisfaction mean scores for the three career fields displayed mixed results. Based on these results which show a distinct absence of significantly positive indices for any of the above three affective work outcomes, and the implication that a majority of the technicians were either undecided about re-enlisting or were intending to separate, the author concluded that job satisfaction may be considered problematic. In light of these findings, diagnosis of the jobs performed by the technician follows.

Step Three: Work Design--Is the Job Low in Motivating Potential?

Hackman and Oldham state that it can be informative to group the five core job characteristics into a single index "that reflects the overall potential of a job to foster internal work motivation on the part of job

incumbents" (17:81). This index, the MPS, is the topic of the third step of this analysis.

Based on an anticipated high task significance component, the author proposed:

Hypothesis 4: The MPS of each career field and the combined maintenance technicians' MPS is significantly higher than the national norm, but the career fields do not vary among themselves.

The null form of the hypothesis, similar to those cited previously, states that no difference in the MPS existed. Table 12 records these results.

TABLE 12

MEAN COMPOSITE MOTIVATING POTENTIAL SCORE BY CAREER FIELD AND COMPARISON ANALYSIS OF SAMPLE MEANS

| | | z-values | | |
|---|---|---|---|---|
| AFSC/(N) | Mean/Std Dev | 1 | 2 | 3 |
| 411X0/(108) | 117.51/68.18 | .58 | | |
| | | | .28 | |
| 411X1/(117) | 114.91/71.21 | .28 | | -.98 |
| | | | -1.26 | |
| 411X2/(89) | 126.50/60.53 | 1.89* | | |
| Total/(314) | 119.09/67.24 | 1.23 | | |
| Nat'l Norm/(500) | 113.38/60.00 | | | |

Note: * indicates value exceeds one-tail significance level of .05.

Significance testing indicated that only the Facilities Maintenance Specialists (411X2) had a high Motivating Potential Score; this may have been partially due to the extensive diversity that characterizes their jobs. The

analysis contained in the next three steps of the diagnostic plan provides some insight into why the Systems Analyst Specialists (411X0) and Missile Maintenance Specialists (411X1) did not have a high MPS. Additionally, some knowledge may be gained from this analysis concerning why the job satisfaction indices for the three career fields did not differ. Thus, with respect to Motivating Potential Score, there is insufficient evidence to entirely reject the null hypothesis.

Step Four: Are There Aspects of the Jobs that Need Improvement?

This component of the diagnostic plan attempts to explain the relative degree of satisfaction and/or dissatisfaction within the maintenance technician specialties by examining the work itself to see if it was a contributing factor. Analysis involved performing large-sample hypothesis testing about the difference between two population means and correlation analysis in an effort to answer the investigative questions. Figures of job profiles augment the tables to help clarify the analysis as it progresses in this key step of the research.

Skill Variety. The hypothesis tested in this analysis was:

Hypothesis 5: The degree to which a job requires the worker to perform activities which challenge his skills and abilities (skill variety) is significantly higher for the Facility Maintenance Specialists, in particular, and for the combined maintenance technicians overall.

The author proposed that the Facilities Maintenance Specialists perform relatively fewer of the repetitive and simple types of tasks than their fellow technicians, and that consequently, their work provides more challenge and immagination. Table 13 shows the results.

TABLE 13

MEAN SCORES FOR SKILL VARIETY BY CAREER FIELD AND COMPARISON ANALYSIS OF SAMPLE MEANS

| | | z-values | | |
|---|---|---|---|---|
| AFSC/(N) | Mean/Std Dev | 1 | 2 | 3 |
| 411X0/(108 | 4.77/1.41 | 3.19** | | |
| | | | 2.81** | |
| 411X1/(117) | 4.23/1.47 | -.47 | | .43 |
| | | | -2.13** | |
| 411X2/(89) | 4.68/1.52 | 2.22* | | |
| Total/(314) | 4.54/1.48 | 2.37* | | |
| Nat'l Norm/(500) | 4.30/1.28 | | | |

Notes:

* indicates value exceeds one-tail significance level of .05.

** indicates value exceeds two-tail significance level of .05.

As hypothesized, the combined AFSCs and the 411X2 AFSC means for skill variety were significantly higher than the national norm. However, the analysis shows that the Systems Analyst Specialists (411X0) also scored significantly higher than the national norm. In addition, the 411X1 AFSC was significantly lower than the other two

career fields, but not to the national norm. Therefore, the null hypothesis is rejected in favor of its alternate (in a slightly amended form, noting the 411X0 results).

Task Identity. The extent of task identity was hypothesized in the null form to be the same as the national norm for the three AFSCs collectively and individually, as well as not differing from one another. Stated in the alternate form, however, the hypothesis is as follows:

Hypothesis 6: Jobs performed by the 411X0, 411X0, and 411X2 career fields are collectively higher in task identity than the national norm; additionally, the Missile Maintenance Specialist AFSC (411X1) mean score for task identity is higher than that of the national norm.

Personnel assigned to the 411X1 career field are able to physically perform tasks that bring an off-alert missile that is in a maintenance bay at the support base each step of the way into its launch silo (in some cases several hundred miles away) to a fully operational on-alert status. Therefore, the author hypothesized that the degree to which the 411X1 career field jobs require completion of a "whole" and identifiable piece of work is higher than for the others. The results are depicted in Table 14.

The analysis indicated that not only is the null hypothesis rejected in favor of the alternate, but in addition, the 411X0 and 411X2 career fields contain elements

TABLE 14

MEAN SCORES FOR TASK IDENTITY BY CAREER FIELD AND COMPARISON ANALYSIS OF SAMPLE MEANS

| AFSC/(N) | Mean/Std Dev | z-values 1 | 2 | 3 |
|---|---|---|---|---|
| 411X0/(108) | 5.07/1.21 | 3.26** | | |
| | | | .58 | |
| 411X1/(117) | 4.97/1.39 | 2.29* | | -.76 |
| | | | -1.28 | |
| 411X2/(89) | 5.20/1.19 | 3.99** | | |
| Total/(314) | 5.07/1.27 | 4.63* | | |
| Nat'l Norm/(500) | 4.65/1.24 | | | |

Notes:

* indicates value exceeds one-tail significance level of .05.

** indicates value exceeds two-tail significance level of .05.

which foster a significantly higher degree of task identity than the national norm.

Task Significance. Based on the author's prior missile experience and previous studies of Air Force aircraft maintenance technicians (15:10), task significance is hypothesized thusly:

Hypothesis 7: The task significance indicated by specialists from all three career fields is comparatively higher than the national norm when grouped together and individually; however, they do not vary among themselves.

The null hypothesis assumes the now familiar form that states the task significance of the AFSCs does not deviate from that of the national norm.

The critical nature of the work itself in a strategic missile wing tends to elicit a feeling that the mission is extremely important; thus, workers see their individual tasks as being worthwhile in and of themselves. Table 15 contains the results of this comparative analysis.

TABLE 15

MEAN SCORES FOR TASK SIGNIFICANCE BY CAREER FIELD AND COMPARISON ANALYSIS OF SAMPLE MEANS

| | | z-values | | |
|---|---|---|---|---|
| AFSC/(N) | Mean/Std Dev | 1 | 2 | 3 |
| 411X0/(108) | 5.99/1.07 | 5.21* | | |
| | | | -.43 | |
| 411X1/(117) | 6.05/1.04 | 6.05* | | 1.29 |
| | | | 1.68 | |
| 411X2/(89) | 5.77/1.28 | 2.62* | | |
| Total/(314) | 5.95/1.12 | 6.87* | | |
| Nat'l Norm/(500) | 5.39/1.15 | | | |

Note: * indicates value exceeds one-tail significance level of .05.

The analysis supports this assertion and categorically rejects the null hypothesis.

Autonomy. Defined as

> . . . the degree to which the job provides substantial freedom, independence, and discretion to the individual in scheduling the work and in determining the procedures to be used in carrying it out, (17:79)

autonomy is a characteristic of missile maintenance jobs which (in many cases) by necessity, has been limited by

higher headquarters in an effort to promote both the safety and security of U.S. nuclear forces. However, there are elements of the missile maintenance environment which do not directly interface with the nuclear components of the missile and its associated subsystems (the Vehicle and Equipment Control Branch is one such example) and, therefore, invite feelings of autonomy. Thus, the author hypothesizes that the measured autonomy indices will not differ substantially from those of the national norm. The null hypothesis states:

Hypothesis 8: The evidence of autonomy in jobs performed by the three AFSCs, both individual and collectively, is the same as the national norm and do not vary from one another.

Results appear in Table 16.

TABLE 16

MEAN SCORES FOR AUTONOMY BY CAREER FIELD AND COMPARISON ANALYSIS OF SAMPLE MEANS

| | | z-values | | |
|---|---|---|---|---|
| AFSC/(N) | Mean/Std Dev | 1 | 2 | 3 |
| 411X0/(108) | 4.34/1.56 | -1.69 | | |
| | | | -.34 | |
| 411X1/(117) | 4.41/1.57 | -1.29 | | -1.75 |
| | | | -1.43 | |
| 411X2/(89) | 4.69/1.24 | .56 | | |
| Total/(314) | 4.47/1.48 | -1.40 | | |
| Nat'l Norm/(500) | 4.61/1.24 | | | |

Note: No significance existed at the .05 level for one-tail or two-tail tests.

Based on the statistical analysis, the response data supports the null hypothesis. The tendency is for jobs to exhibit a below average degree of autonomy, but not at a significant level.

Feedback. The JDS measures job feedback by tapping feedback stemming directly from the job and also feedback from agents (some other person, such as a co-worker or a supervisor). Both types can contribute to the overall knowledge a technician has of the results of the work he performed; however, the focus of this step was to ascertain the degree of the construct contributed by the work itself. Thus, for the purpose of this discussion, feedback from the work itself received the primary focus.

Due partially to the tier structure of maintenance in general, and the distance involved between the home support base and the Launch Facilities and Launch Control Facilities in conjunction with the overall deterrent nature of the weapon system, the author hypothesized that:

Hypothesis 9: The degree of feedback from the job is lower for jobs performed by the three career fields sampled than is present in jobs measured by the national norm, and does not vary among the AFSCs.

The null hypothesis states that job feedback does not differ measurably from the national norm. Table 17 lists the results.

TABLE 17

MEAN SCORES FOR FEEDBACK FROM THE WORK ENVIRONMENT BY CAREER FIELD AND COMPARISON ANALYSIS

| AFSC/(N) | Mean/Std Dev | z-values 1 | 2 | 3 |
|---|---|---|---|---|
| Feedback from Job | | | | |
| 411X0/(108) | 4.79/1.19 | .71 | | |
| | | | 1.07 | |
| 411X1/(117) | 4.61/1.33 | -.67 | | -.52 |
| | | | -1.51 | |
| 411X2/(89) | 4.88/1.23 | 1.27 | | |
| Total/(314) | 4.75/1.26 | .56 | | |
| Nat'l Norm/(500) | 4.70/1.23 | | | |
| Feedback from Agents | | | | |
| 411X0/(108) | 4.42/1.47 | 2.91** | | |
| | | | -.10 | |
| 411X1/(117) | 4.44/1.64 | 2.87** | | -.75 |
| | | | -.64 | |
| 411X2/(89) | 4.58/1.50 | 3.57** | | |
| Total/(314) | 4.47/1.54 | 4.68** | | |
| Nat'l Norm/(500) | 3.97/1.39 | | | |

Note: ** indicates value exceeds two-tail significance level of .05.

Thus, at the $\alpha = .05$ level of significance there is insufficient evidence to reject the null hypothesis. Based on this result, indications pointed to no significant difference in the degree to which the three AFSCs perceived their work as providing them feedback, and no difference between the maintenance technicians and the national norm.

The other type of job feedback (from agents) was hypothesized (Hypothesis 10) not to appreciably vary from career field to career field, or to vary from the national norm. Table 17, however, rejects this hypothesis, indicating a significantly higher level of feedback from supervisors (and other "agents") than the average non-managerial worker.

Dealing with Others. The final job dimension measured by the JDS involving the work itself category was the construct "dealing with others." Similar to the previous construct, dealing with others is not directly related to work redesign; its presence or absence can be more a function of personal or management style rather than a function of the job itself (15:109). In the missile maintenance environment, local (wing) policies, Strategic Air Command Headquarters directives, and Air Force regulations dictate that even though a job may be performed in relative isolation (as often happens on a dispatch to a site), the technician will routinely report his actions, and any

difficulties or deviations that arise, to a number of agencies. Consequently, the author hypothesized:

Hypothesis 11: The extent to which the three career fields deal with others will be above the national norm, both individually and collectively, and the three career fields will not vary among themselves.

The null form of this hypothesis states that the level of dealing with others is the same in the three career fields and does not differ from that of the national norm. Table 18 tabulates and compares this data.

TABLE 18

MEAN SCORES FOR DEALING WITH OTHERS BY CAREER FIELD AND COMPARISON ANALYSIS OF SAMPLE MEANS

| | | z-values | | |
|---|---|---|---|---|
| AFSC/(N) | Mean/Std Dev | 1 | 2 | 3 |
| 411X0/(108) | 5.91/1.00 | 6.29* | | |
| | | | -1.52 | |
| 411X1/(117) | 6.11/0.97 | 8.60* | | 1.26 |
| | | | 2.75** | |
| 411X2/(89) | 5.73/0.99 | 4.31* | | |
| Total/(314) | 5.93/0.99 | 9.40* | | |
| Nat'l Norm/(500) | 5.23/1.10 | | | |

Notes:

* indicates value exceeds one-tail significance level of .05.

** indicates value exceeds two-tail significance level of .05.

The response data supports the alternate hypothesis with respect to the AFSCs and the national norm. An additional note is that 411X1 career field personnel perceive

themselves as dealing with others to a significantly higher extent than do the Facilities Maintenance Specialists.

Having progressed through the comparison of means analysis portion of this step, a summarization of the job characteristics and dimensions studied up to this point in the analysis may help solidify those findings that have surfaced. Table 19 charts these results.

Step four thus far involved analysis of the jobs on each of the five core dimensions to extract specific strengths and weaknesses. A Systems Analyst job "profile" is shown in Figure 5, followed by the Missile Maintenance Specialists in Figure 6, and the Missile Facilities Specialists in Figure 7. Figure 8 details the three AFSCs as plotted against the national norm. These figures help reinforce what the findings have verified thus far in determining what aspects of the jobs are causing apparent difficulties.

Correlation Analysis. Tables 20 through 23 portray the intercorrelations among the sixteen job characteristics and attitudes measured in this study by the JDS. A summary of correlations between affective work outcomes (job satisfaction, internal work motivation, and growth satisfaction) and the measured job characteristics and dimensions appears in Table 24. This last table focuses on those factors most highly correlated (correlation

TABLE 19

SUMMARY TABLE OF HYPOTHESIS TESTING PERFORMED IN STEPS TWO THROUGH FOUR

A. AFSCs Compared with National Norm

| Construct | Combined | 411X0 | 411X1 | 411X2 | Results |
|---|---|---|---|---|---|
| Job Satisfaction | -- | -- | -- | -- | NS |
| Internal Motivation | -- | -- | -- | -- | NS |
| Growth Satisfaction | Lo | Lo | Lo | Lo | NS |
| MPS | Hi | Lo | Hi | Hi* | S |
| Skill Variety | Hi* | --** | -- | Hi* | S |
| Task Identity | Hi* | --** | Hi* | --** | S |
| Task Significance | Hi* | Hi* | Hi* | Hi* | S |
| Autonomy | -- | -- | -- | -- | NS |
| Feedback (Job) | Lo | Lo | Lo | Lo | NS |
| Feedback (Agents) | --** | --** | --** | --** | S |
| Dealing with Others | Hi* | Hi* | Hi* | Hi* | S |

B. AFSCs Compared with each Other

(In only two instances did the AFSCs significantly differ from one another; these instances are listed below)

| Construct | 411X0 | 411X1 | 411X2 |
|---|---|---|---|
| Skill Variety | Hi*** | Lo*** | Hi*** |
| Dealing with Others | -- | Hi*** | Lo*** |

Notes:

*Significant at $\alpha = .05$ (one-tail test).

**Significant at $\alpha = .05$ (two-tail test).

***indicates a difference existed (none was hypothesized) at a two-tail significance level of .05.

S indicates result is statistically significant.

NS indicates result is not statistically significant.

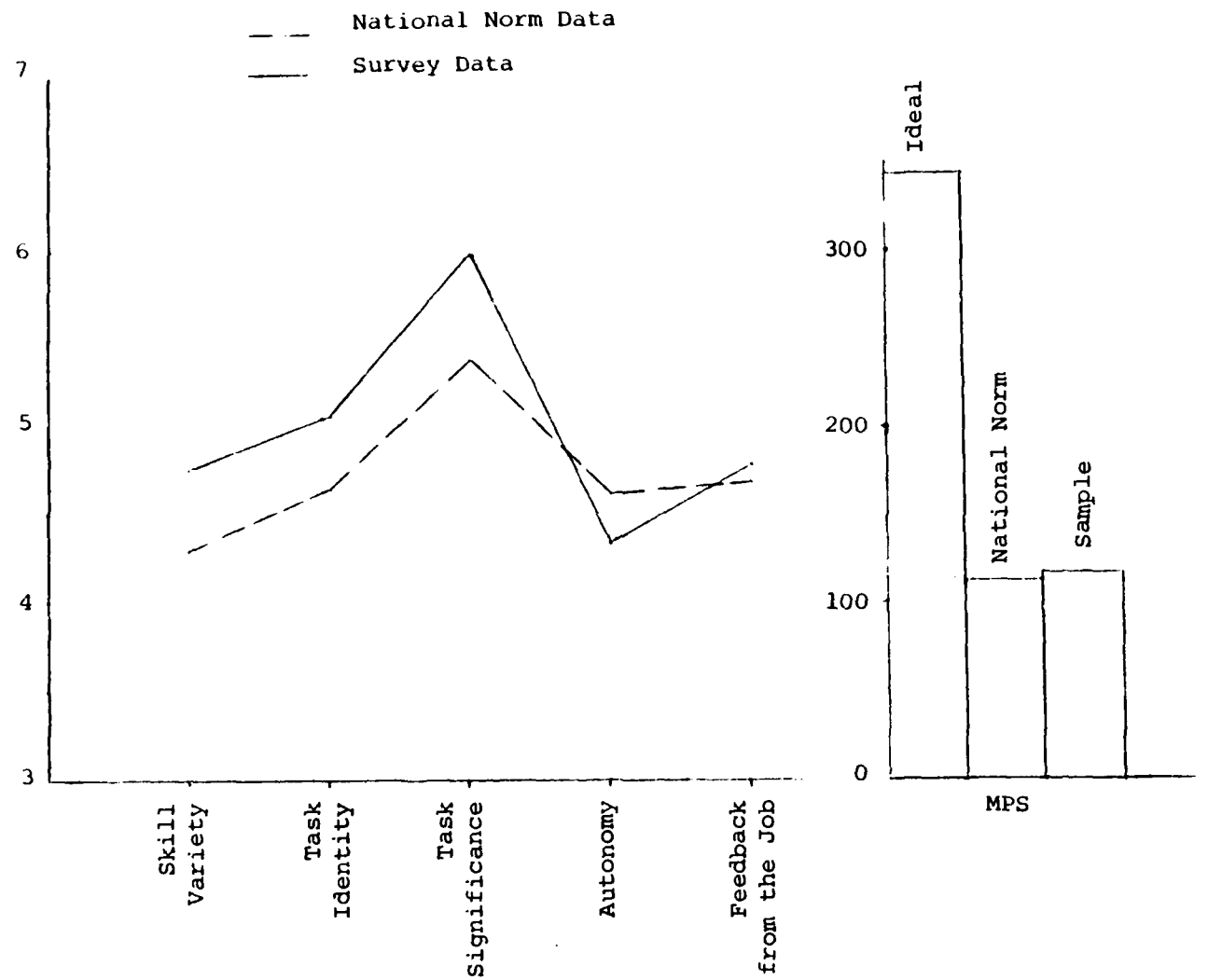



Fig. 5. The JDS Diagnostic Profile for Systems Analyst Specialists (411X0)

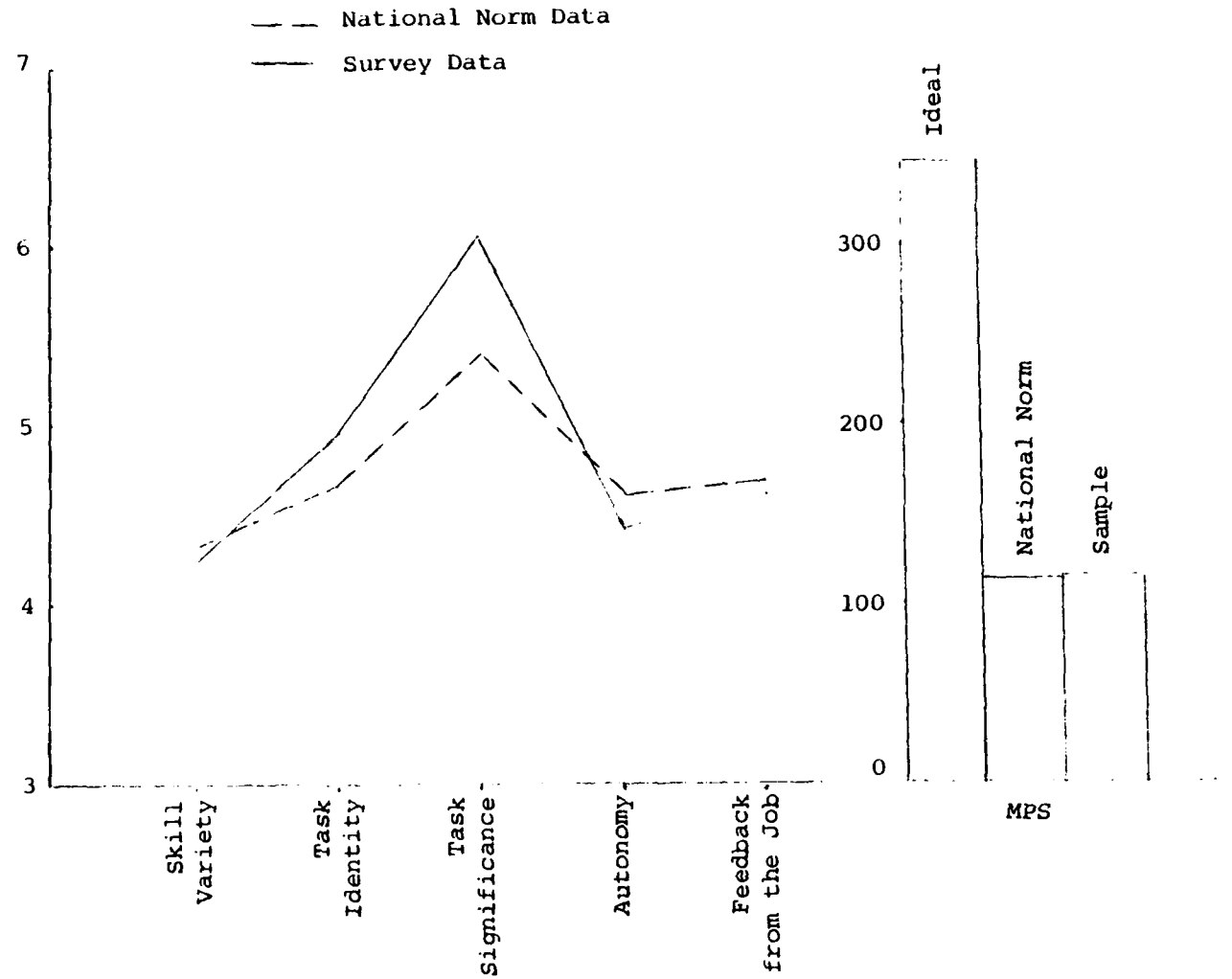



Fig. 6. The JDS Diagnostic Profile for Missile Maintenance Specialists (411X1)

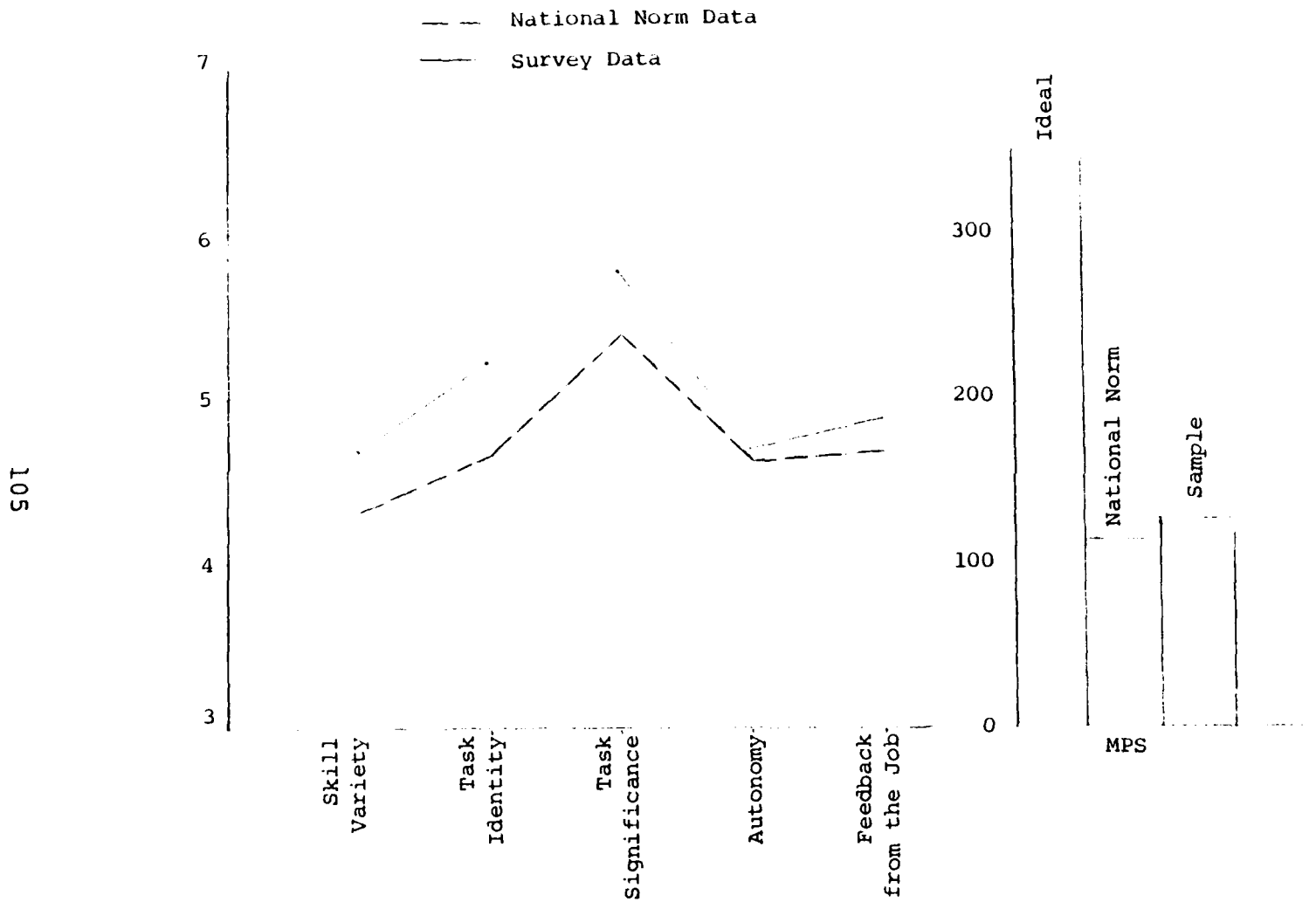



Fig. 7. The JDS Diagnostic Profile for Missile Facilities Specialists (411X2)

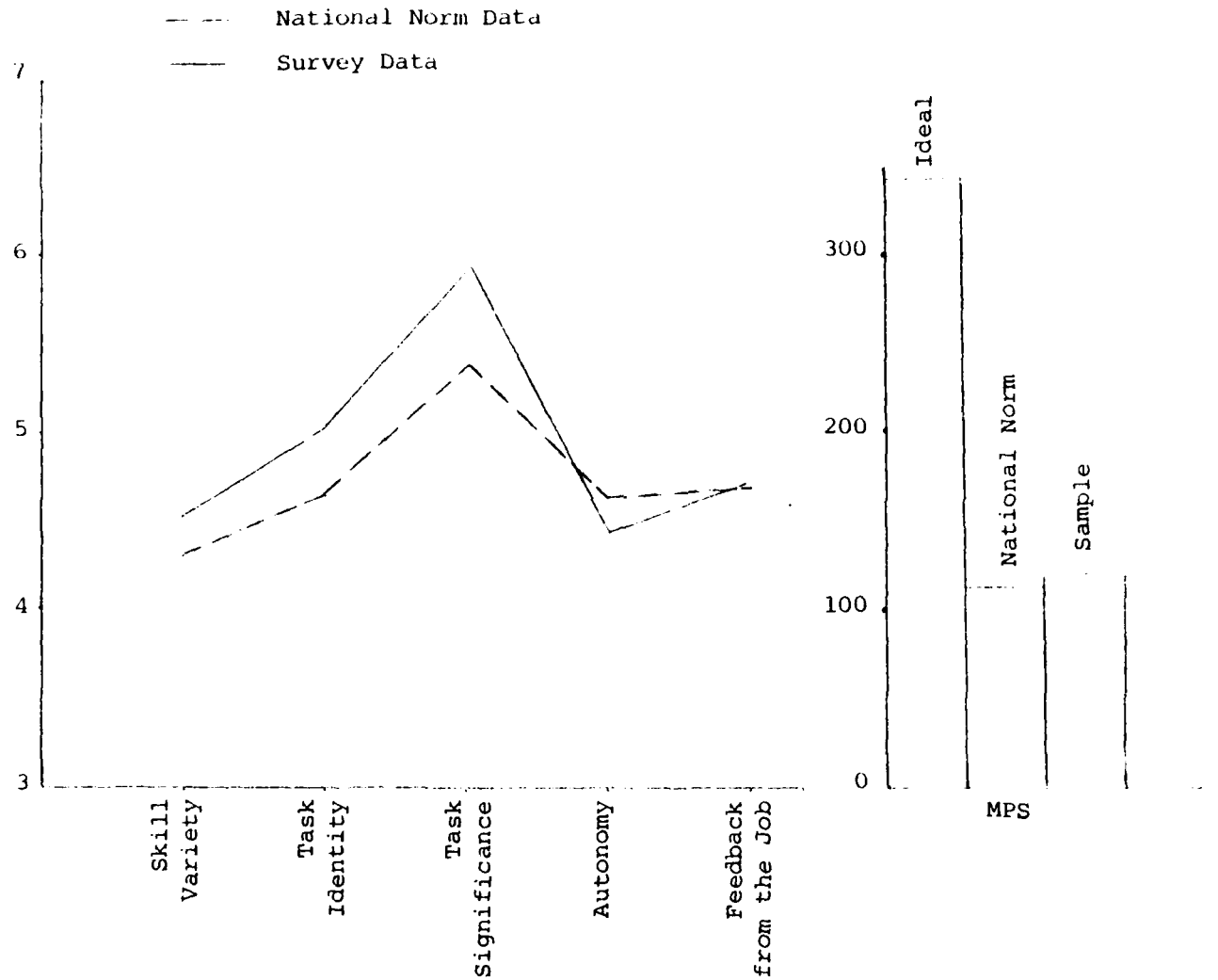



Fig. 8. The JDS Diagnostic Profile for the Combined Maintenance Technicians

TABLE 20

INTERCORRELATIONS AMONG JOB CHARACTERISTICS AND ATTITUDE INDICES
(COMBINED MAINTENANCE TECHNICIANS--411X0, 411X1, AND 411X2)

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Skill Variety | * | 29 | 36 | 41 | 40 | 34 | 26 | 46 | 33 | 05 | 28 | 27 | 21 | 59 | 00 | 59 |
| 2. | Task Identity | | * | 18 | 28 | 30 | 24 | 01 | 32 | 29 | 08 | 30 | 28 | 26 | 33 | 05 | 45 |
| 3. | Task Significance | | | * | 19 | 33 | 23 | 30 | 31 | 37 | 04 | 26 | 23 | 19 | 33 | 07 | 39 |
| 4. | Autonomy | | | | * | 41 | 34 | 10 | 55 | 36 | 20 | 27 | 47 | 41 | 67 | 06 | 81 |
| 5. | Feedback (Job) | | | | | * | 45 | 13 | 44 | 41 | 18 | 30 | 28 | 29 | 44 | 08 | 76 |
| 6. | Feedback (Agents) | | | | | | * | 25 | 37 | 29 | 20 | 29 | 36 | 54 | 42 | -02 | 44 |
| 7. | Dealing with Others | | | | | | | * | 16 | 26 | 03 | 20 | 26 | 15 | 21 | 02 | 14 |
| 8. | Job Satisfaction | | | | | | | | * | 48 | 17 | 48 | 45 | 45 | 75 | 03 | 60 |
| 9. | Internal Motivation | | | | | | | | | * | 15 | 30 | 34 | 27 | 47 | 21 | 46 |
| 10. | Pay Satisfaction | | | | | | | | | | * | 38 | 28 | 31 | 29 | 00 | 21 |
| 11. | Security Satisfaction | | | | | | | | | | | * | 41 | 44 | 50 | 07 | 36 |
| 12. | Social Satisfaction | | | | | | | | | | | | * | 53 | 61 | 09 | 45 |
| 13. | Supervisory Satisfaction | | | | | | | | | | | | | * | 52 | 02 | 42 |
| 14. | Growth Satisfaction | | | | | | | | | | | | | | * | 03 | 69 |
| 15. | Growth Need Strength | | | | | | | | | | | | | | | * | 14 |
| 16. | Motivating Potential Score | | | | | | | | | | | | | | | | * |

Notes: N = 314.

* indicates value = 1.0.

TABLE 21

INTERCORRELATIONS AMONG JOB CHARACTERISTICS AND ATTITUDE INDICES
(SYSTEMS ANALYST SPECIALISTS--411X0)

| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Skill Variety | * | 22 | 24 | 34 | 36 | 32 | 22 | 47 | 30 | 06 | 16 | 16 | 16 | 52 | -05 | 53 |
| 2. Task Identity | | * | 14 | 42 | 27 | 20 | -14 | 44 | 27 | 21 | 40 | 38 | 44 | 43 | 14 | 52 |
| 3. Task Significance | | | * | 08 | 31 | 15 | 20 | 13 | 30 | 00 | 02 | 12 | 06 | 18 | 14 | 30 |
| 4. Autonomy | | | | * | 31 | 32 | -02 | 58 | 35 | 28 | 15 | 49 | 52 | 68 | 02 | 81 |
| 5. Feedback (Job) | | | | | * | 41 | 15 | 34 | 37 | 22 | 25 | 30 | 35 | 37 | 11 | 72 |
| 6. Feedback (Agents) | | | | | | * | 22 | 38 | 16 | 12 | 20 | 36 | 54 | 36 | 06 | 43 |
| 7. Dealing with Others | | | | | | | * | 06 | 09 | -03 | 13 | 19 | -02 | 08 | 04 | 06 |
| 8. Job Satisfaction | | | | | | | | * | 47 | 17 | 39 | 41 | 60 | 76 | -03 | 63 |
| 9. Internal Motivation | | | | | | | | | * | 16 | 32 | 29 | 19 | 47 | 37 | 46 |
| 10. Pay Satisfaction | | | | | | | | | | * | 23 | 27 | 28 | 33 | 03 | 31 |
| 11. Security Satisfaction | | | | | | | | | | | * | 42 | 46 | 41 | 04 | 26 |
| 12. Social Satisfaction | | | | | | | | | | | | * | 53 | 55 | 17 | 46 |
| 13. Supervisory Satisfaction | | | | | | | | | | | | | * | 61 | 06 | 54 |
| 14. Growth Satisfaction | | | | | | | | | | | | | | * | 06 | 70 |
| 15. Growth Need Strength | | | | | | | | | | | | | | | * | 10 |
| 16. Motivating Potential Score | | | | | | | | | | | | | | | | * |

Notes: N = 108.

* indicates value = 1.0.

TABLE 22

INTERCORRELATIONS AMONG JOB CHARACTERISTICS AND ATTITUDE INDICES
(MAINTENANCE SPECIALISTS--411X1)

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Skill Variety | * | 40 | 32 | 48 | 44 | 32 | 29 | 45 | 28 | -07 | 30 | 30 | 14 | 62 | 02 | 63 |
| 2. | Task Identity | | * | 26 | 24 | 37 | 29 | 20 | 31 | 36 | 01 | 42 | 28 | 21 | 31 | -06 | 44 |
| 3. | Task Significance | | | * | 13 | 33 | 13 | 32 | 33 | 27 | -02 | 31 | 16 | 11 | 29 | 07 | 33 |
| 4. | Autonomy | | | | * | 58 | 36 | 10 | 57 | 42 | 16 | 29 | 52 | 28 | 69 | 04 | 85 |
| 5. | Feedback (Job) | | | | | * | 47 | 28 | 51 | 50 | 20 | 36 | 37 | 24 | 53 | 01 | 80 |
| 6. | Feedback (Agents) | | | | | | * | 28 | 40 | 40 | 29 | 32 | 33 | 53 | 47 | -14 | 40 |
| 7. | Dealing with Others | | | | | | | * | 23 | 29 | 02 | 21 | 21 | 17 | 23 | -01 | 17 |
| 8. | Job Satisfaction | | | | | | | | * | 47 | 16 | 55 | 55 | 29 | 76 | 04 | 58 |
| 9. | Internal Motivation | | | | | | | | | * | 17 | 27 | 35 | 36 | 42 | 13 | 45 |
| 10. | Pay Satisfaction | | | | | | | | | | * | 42 | 23 | 35 | 23 | 02 | 14 |
| 11. | Security Satisfaction | | | | | | | | | | | * | 43 | 42 | 57 | 05 | 39 |
| 12. | Social Satisfaction | | | | | | | | | | | | * | 50 | 66 | 01 | 47 |
| 13. | Supervisory Satisfaction | | | | | | | | | | | | | * | 39 | 00 | 27 |
| 14. | Growth Satisfaction | | | | | | | | | | | | | | * | -01 | 68 |
| 15. | Growth Need Strength | | | | | | | | | | | | | | | * | 12 |
| 16. | Motivating Potential Score | | | | | | | | | | | | | | | | * |

Notes: N = 117.

* indicates value = 1.0.

TABLE 23

INTERCORRELATIONS AMONG JOB CHARACTERISTICS AND ATTITUDE INDICES
(FACILITIES SPECIALISTS--411X2)

| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. | Skill Variety | * | 20 | 56 | 42 | 38 | 41 | 35 | 52 | 45 | 19 | 43 | 43 | 40 | 66 | 08 | 62 |
| 2. | Task Identity | | * | 15 | 12 | 19 | 19 | -03 | 18 | 21 | 01 | 44 | 18 | 11 | 22 | 09 | 36 |
| 3. | Task Significance | | | * | 47 | 39 | 44 | 36 | 50 | 55 | 15 | 45 | 43 | 44 | 57 | 00 | 62 |
| 4. | Autonomy | | | | * | 26 | 33 | 32 | 46 | 31 | 16 | 44 | 37 | 46 | 64 | 15 | 75 |
| 5. | Feedback (Job) | | | | | * | 45 | -03 | 46 | 35 | 12 | 28 | 15 | 32 | 39 | 14 | 75 |
| 6. | Feedback (Agents) | | | | | | * | 28 | 38 | 29 | 19 | 36 | 41 | 57 | 42 | 03 | 51 |
| 7. | Dealing with Others | | | | | | | * | 19 | 44 | 11 | 28 | 44 | 33 | 39 | 06 | 24 |
| 8. | Job Satisfaction | | | | | | | | * | 49 | 17 | 48 | 34 | 46 | 74 | 10 | 60 |
| 9. | Internal Motivation | | | | | | | | | * | 10 | 30 | 39 | 28 | 55 | 12 | 47 |
| 10. | Pay Satisfaction | | | | | | | | | | * | 50 | 36 | 31 | 35 | -08 | 17 |
| 11. | Security Satisfaction | | | | | | | | | | | * | 38 | 45 | 54 | 14 | 47 |
| 12. | Social Satisfaction | | | | | | | | | | | | * | 56 | 63 | 09 | 41 |
| 13. | Supervisory Satisfaction | | | | | | | | | | | | | * | 61 | -03 | 51 |
| 14. | Growth Satisfaction | | | | | | | | | | | | | | * | 03 | 67 |
| 15. | Growth Need Strength | | | | | | | | | | | | | | | * | 21 |
| 16. | Motivating Potential Score | | | | | | | | | | | | | | | | * |

Notes: N = 89.

* indicates value = 1.0.

TABLE 24

CORRELATIONS BETWEEN AFFECTIVE OUTCOMES AND MEASURED JOB DIMENSIONS (COMBINED MAINTENANCE TECHNICIANS--411X0, 411X1, AND 411X2)

| | Job Satisfaction | Internal Work Motivation | Growth Satisfaction |
|---|---|---|---|
| Skill Variety | 46 | 33 | 59 |
| Task Identity | 32 | 29 | 33 |
| Task Significance | 31 | 37 | 33 |
| Autonomy | 55 | 36 | 67 |
| Feedback (Job) | 44 | 41 | 44 |
| Feedback (Agents) | 37 | 29 | 42 |
| Dealing with Others | 16 | 26 | 21 |
| Pay Satisfaction | 17 | 15 | 29 |
| Security Satisfaction | 48 | 30 | 50 |
| Social Satisfaction | 45 | 34 | 61 |
| Supervisory Satisfaction | 45 | 27 | 52 |
| Growth Need Strength | 03 | 21 | 03 |
| Motivating Potential Score | 60 | 46 | 69 |
| Job Satisfaction | * | - | - |
| Internal Motivation | 48 | * | - |
| Growth Satisfaction | 75 | 47 | * |

Notes: N = 314.

* indicates value = 1.0.

analysis is used to determine whether or not one variable influences another variable, without implying causality) with the vital affective outcomes.

First, job satisfaction was highly correlated with the motivating potential score, autonomy, and security satisfaction. Conversely, it showed almost no correlation with growth need strength and dealing with others.

Second, internal work motivation showed a strong correlation with the MPS and feedback from the job; it showed a relatively weak correlation to pay satisfaction.

Third, growth satisfaction proved to be highly correlated with the MPS, autonomy, social satisfaction and skill variety. It was only loosely correlated with growth need strength, pay satisfaction and dealing with others.

Analysis of the survey data by individual AFSC and when combined showed that growth satisfaction was the variable most highly associated with job satisfaction. Recalling Table 11, questionnaire results indicated that the actual amount of growth satisfaction perceived by the workers did not differ from that of the national norm. Two of the AFSCs (411X0 and 411X2) were, in fact, somewhat lower than the national norm.

Additionally, the correlation analysis indicated that the degree of autonomy in a job has an extremely high association not only with job satisfaction, but with the other affective work outcomes as well. Accordingly,

Table 16 recorded the results of the perceived level of autonomy present in jobs performed by maintenance workers; the apparent tendency among technicians was that more emphasis on autonomy would be welcomed.

Step Five: Are There Aspects of the Work Context that Need Improvement?

Three of the four variables categorized as describing the work environment (social satisfaction, supervisory satisfaction, and security satisfaction) exhibited fairly strong correlations with job satisfaction and other affective work outcomes in the previous step. This suggested that these context factors (rather than the work itself) may have played a significant role in the results recorded in the second step of this diagnosis.

Step Five conducted an analysis using large-sample hypothesis testing about the difference between two population means in an effort to further pinpoint perceived sources of dissatisfaction in the job settings of the maintenance workers.

Pay Satisfaction. When soldiers came to him in the wilderness asking what they should do in response to his message, it is recorded that John (the baptizer) charged them to be content with their wages, and to rob no one by violence. Presently, military personnel seem

to be capable of keeping to only half of this platitude, and the author hypothesized:

Hypothesis 12: The pay satisfaction of the three career fields, both individually and collectively, is below the national norm, but does not differ from one career field to another.

The null hypothesis states that the pay satisfaction of the airmen sampled is the same as the national norm. Table 25 reveals the results.

TABLE 25

MEAN SCORES FOR PAY SATISFACTION BY CAREER FIELD AND COMPARISON ANALYSIS OF SAMPLE MEANS

| | | z-values | | |
|---|---|---|---|---|
| AFSC/(N) | Mean/Std Dev | 1 | 2 | 3 |
| 411X0/(108) | 3.62/1.65 | -3.16* | | |
| | | | -.14 | |
| 411X1/(117) | 3.65/1.56 | -3.24* | | .17 |
| | | | .31 | |
| 411X2/(89) | 3.58/1.61 | -3.19* | | |
| Total/(314) | 3.62/1.60 | -4.89* | | |
| Nat'l Norm/(500) | 4.16/1.42 | | | |

Note: * indicates value exceeds one-tail significance level of .05.

As hypothesized in the alternate form, the level of pay satisfaction of the Air Force technicians surveyed was significantly below the national norm and did not vary between AFSCs. Thus, the null hypothesis was rejected.

Security Satisfaction. The longevity of the Minuteman system coupled with the Department of Defense retention and retirement system were thought to contribute to a higher security satisfaction among Air Force personnel; thus, the alternate hypothesis expresses:

Hypothesis 13: The technicians' satisfaction with their overall job security is higher than that of the national norm, and does not differ from one AFSC to another.

The null form hypothesizes that security satisfaction is the same in the career fields as the national norm. Table 26 records the survey results.

TABLE 26

MEAN SCORES FOR SECURITY SATISFACTION BY CAREER FIELD AND COMPARISON ANALYSIS OF SAMPLE MEANS

| | | z-values | | |
|---|---|---|---|---|
| AFSC/(N) | Mean/Std Dev | 1 | 2 | 3 |
| 411X0/(108) | 4.82/1.48 | .72 | | |
| | | | -.52 | |
| 411X1/(117) | 4.92/1.41 | 1.49 | | -.19 |
| | | | .29 | |
| 411X2/(89) | 4.86/1.52 | .88 | | |
| Total/(314) | 4.87/1.46 | 1.62 | | |
| Nat'l Norm/(500) | 1.71/1.21 | | | |

Note: No significance existed at the .05 level for one-tail or two-tail tests.

Although the results indicate an above average satisfaction among the technician subgroups, the data analysis indicates that insufficient evidence exists to

reject the null hypothesis at the chosen significance level. The concluding chapter of this study provides additional insight into this finding.

Social Satisfaction. For a number of reasons, the social satisfaction of maintenance technicians in all three career fields was thought to be below the national norm. First, the jobs involve repetitive drives over long distances to the remote Launch Facilities and Launch Control Facilities, very little social interaction once at the site, and naturally, the long drive back to the support base. Second, several of the missile wings are geographically removed from towns with substantial urbanization (most notably Whiteman AFB, Minot AFB, and Grand Forks AFB). Finally, the perception exists at some Strategic Air Command bases that have both the ICBM and manned bomber components of the strategic triad that the missile personnel are not as highly esteemed as their fellow airmen who engage in the flying business. The alternate hypothesis is thusly stated:

Hypothesis 14: The social satisfaction of personnel assigned to the three AFSCs studied, both individually and collectively, is below that of the national norm, but does not vary among career fields.

The null hypothesis expresses no difference in social satisfaction between the Air Force sample members and the national norm. Table 27 charts these results.

TABLE 27

MEAN SCORES FOR SOCIAL SATISFACTION BY CAREER FIELD AND COMPARISON ANALYSIS OF SAMPLE MEANS

| AFSC/(N) | Mean/Std Dev | z-values 1 | 2 | 3 |
|---|---|---|---|---|
| 411X0/(108) | 5.20/1.02 | -.47 | | |
| | | | -1.15 | |
| 411X1/(117) | 5.36/1.07 | 1.02 | | -.29 |
| | | | .87 | |
| 411X2/(89) | 5.24/0.91 | -.09 | | |
| Total/(314) | 5.27/1.01 | .28 | | |
| Nat'l Norm/(500) | 5.25/0.96 | | | |

Note: No significance existed at the .05 level for one-tal or two-tail tests.

The social satisfaction perceived by the Systems Analyst Specialists (411X0) and Missile Facilities Specialists (411X2) was found to be below the national norm (as indicated by the negative z-values) while that of the Missile Maintenance Specialists (411X1) was above the norm, but none of these results was at a significant level. The null hypothesis cannot therefore be rejected.

Supervisory Satisfaction. Due to the number of levels of supervision present in missile maintenance organizations (as described in Chapter II), the author found it difficult to generalize over the entire network of supervisors and develop specific relationships. It is therefore hypothesized:

Hypothesis 15: The supervisory satisfaction of the three career fields, both individually and collectively, does not differ from the national norm, nor does it differ among the career fields.

Table 28 contains the results of this analysis.

TABLE 28

MEAN SCORES FOR SUPERVISORY SATISFACTION BY CAREER FIELD AND COMPARISON ANALYSIS OF SAMPLE MEANS

| | | z-values | | |
|---|---|---|---|---|
| AFSC/(N) | Mean/Std Dev | 1 | 2 | 3 |
| 411X0/(108) | 4.74/1.54 | -.50 | | |
| | | | -1.26 | |
| 411x1/(117) | 5.00/1.55 | 1.15 | | -1.22 |
| | | | .00 | |
| 411X2/(89) | 5.00/1.44 | 1.09 | | |
| Total/(314) | 4.91/1.52 | .85 | | |
| Nat'l Norm/(500) | 4.82/1.39 | | | |

Note: No significance existed at the .05 level for one-tail or two-tail tests.

The scores reveal very little difference between the subgroups measured and the associated satisfaction of the national norm with respect to supervision. The null hypothesis holds true in this last measure of worker satisfaction in contextual (hygiene) factors. The analysis now moves to the last step in the diagnostic scene.

Step Six: How "Ready" are the Maintenance Workers for Change?

Hackman and Oldham note in their discussion on the role of differences among people: "Jobs high in motivating

potential create opportunities for considerable self-direction, learning, and personal accomplishment at work" (17:85). However, not all of the technicians can be expected to appreciate such opportunities, even among those specialists who would be able to actually accomplish the work in a highly qualified manner. These individuals either may not recognize the fact that such opportunities exist (they may be withdrawn), they may consider them to be threatening to themselves and/or their careers and balk at being stretched too thin by their work, or they may perceive that added responsibility will bring additional accountability and a resultant separation from the security of their present peer group. Therefore, the author hypothesized:

Hypothesis 16: The growth need strength of the Systems Analyst, Missile Maintenance, and Missile Facilities specialists is singularly and collectively higher than that of the national norm, and is not significantly different for any one AFSC.

The null hypothesis assumes the three career fields to be the same as the national norm and that no one AFSC would dominate the others in the amount of perceived growth need strength. The results appear in Table 29.

The null hypothesis (Table 29) is therefore rejected in favor of the alternate and the author proposes that based on these results, any change program would be favorably accepted.

TABLE 29

MEAN SCORES FOR INDIVIDUAL GROWTH NEED STRENGTH BY CAREER FIELD AND COMPARISON ANALYSIS OF SAMPLE MEANS

| AFSC/(N) | Mean/Std Dev | z-values 1 | 2 | 3 |
|---|---|---|---|---|
| 411X0/(108) | 5.80/1.15 | 1.89* | | |
| | | | -.96 | |
| 411X1/(117) | 5.94/1.03 | 3.44* | | -1.16 |
| | | | -.28 | |
| 411X2/(89) | 5.98/1.02 | 3.44* | | |
| Total/(314) | 5.90/1.07 | 4.21* | | |
| Nat'l Norm/(500) | 5.57/1.12 | | | |

Note: * indicates value exceeds one-tail significance level of .05.

The completion of this step thus finalizes the diagnostic process and provides the basis for the conclusions and recommendations that follow.

## V. Overview, Conclusions, and Recommendations

You can show me your sales curves,
Plot my life on a flow chart,
But there's just some things
That numbers can't measure,
These fragile pieces of priceless treasure.

— Bob Bennett (from
"Matters of the Heart")

### Overview

While acknowledging the march toward technological superiority as the Air Force presses to meet the challenges of the 21st century, and in light of the recruiting advertisements which all but promise a rewarding, high-tech future to any one who elects to don the "blue suit," the fact remains that personnel continue to be required to perform tasks unrelated to those at the cutting edge of scientific endeavor. Current maintenance tasks, for instance, require workers to prepare vehicles for dispatching (this includes routine upkeep), replace worn-out parts at remote sites (this includes shoveling snow to gain access in winter, and cleaning up the site), and perform many other routine but necessary tasks that go along with the mission of maintaining a nuclear deterrent force in the upper heartland of America. Thus, the potential exists in the missile environment for workers' experiences not to match their

desires and expectations. This dissatisfaction was borne out by the percentage (57 percent) of technicians sampled in this study who responded that their jobs were a major factor in their decisions to separate, or were undecided about their career intent.

This study has focused on three career fields (Missile Systems Analyst Specialists, Missile Maintenance Specialists, and Missile Facilities Specialists) and the inherent levels of satisfaction and meaningfulness perceived as being provided by their work. The first chapter provided background to the environment studied, suggesting that job satisfaction, motivation, and/or retention aspects of the Strategic Air Command missile maintenance organizations may be problematic. The review of the literature that followed in Chapter II provided an information base which allowed a more comprehensive understanding of the methodological design of the study. This design (the blueprint of the research) formed the basis of Chapter III. The fourth chapter contains the results of the analysis performed on the sample group of maintenance technicians working in the Minuteman environment.

This study has attempted to diagnose the existing jobs of specialists employed in strategic missile maintenance tasks in order to categorize, in relative terms, the degree of satisfaction/dissatisfaction with the work and the contributing factors thereof. The aim was to

provide management with a thorough awareness of the problems and opportunities which exist in this critical component of the six Minuteman missile wings. Additionally, the study may serve as a reference for commanders intending to implement changes in the existing design of tasks as well as for planners of systems now in the research and development phase of acquisition. An important caveat is that many of the constructs (i.e., job satisfaction) tested were subjective statements revealing perceptions that the workers expressed at the time they completed the survey. And while the measurement instrument used (the Job Diagnostic Survey) has been shown to be a reliable tool, no universal job enrichment program can be formulated to meet the needs of all workers at all levels. Overall, the conclusions drawn by the author in this chapter reflect the findings presented in Chapter IV, as conditioned by the theories of Herzberg, Vroom, and Hackman and Oldham.

## Conclusions

A comparative analysis of mean job satisfaction scores for the three career fields studied indicated that no significant difference in job satisfaction levels is perceived among the technician groups. Therefore, no one career field can be statistically singled out as being problematic. Concurrently, when the indices for this study group were compared with job satisfaction indices for

the national norm, maintenance technicians appear to be as equally satisfied with their jobs as were other workers in general.

Further, analysis of the mean scores for core job dimensions of the specialists sampled revealed that they were moderately satisfied with the present structure of their current jobs and that this level of perceived satisfaction was relatively uniform throughout the three enlisted AFSCs. The only noteworthy exception which surfaced was the low level of skill variety perceived by workers in the Missile Maintenance Specialist AFSC (411X1). The full model of the job characteristics theory (see Appendix A) indicates that by combining routine tasks and establishing client relationships, some potential gains may be realized by the Missile Maintenance Specialists in experiencing more meaningful work.

An additional observation relating to the characteristics of the jobs studied is that the mean score for the autonomy of the combined group of technicians was below that of the national norm. While this tendency was hypothesized at the outset, its lack of statistical significance does not support the premise that the workers are overly satisfied with the freedom, independence, and discretion they have in scheduling work and determining how it will be carried out. For instance, of the people who wrote comments concerning their present job's influence on

their decision to re-enlist, the following responses pertaining to autonomy were noted:

> "Give team chiefs more decision making responsibility and allow us more input to the way things are carried out"
>
> "I feel like my job should be more challenging and I would like to be able to do more on my own."
>
> "Too much tech data for an easy task. They should do away with alot of it."

In contrast to this sentiment, one technician stated:

> "I am extremely satisfied with my job! I make most of my own decisions. When I do my job well, I feel that I'm an integral part of the who[illegible] unit's accomplishments."

This latter view, however, was representative of only a small percentage of those who responded in writing.

The dilemma presented here is certainly not new to Air Force managers and there are no quick fixes or easy answers forthcoming. With respect to maintaining nuclear weapons in particular, commanders are faced with an apparent contradiction of interests if they simultaneously attempt to retain strict adherence to nuclear surety and missile safety while implementing autonomy measures through a concept known as "vertical loading" (see Appendix A). Vertical loading suggests:

> 1. Return to the job holder greater discretion in deciding on work methods, checking on quality, and helping to train less experienced workers;
> 2. Grant additional authority;
> 3. The job holder should have the greatest possible freedom to decide when to start and stop work, and how to assign priorities;
> 4. Workers should be encouraged to seek problem solutions on their own. (20:64)

An important generalization to consider at this point is that various forms of organization design probably constrain and/or facilitate task design processes. In organizations with organic designs (a research and development unit, for instance), tasks are likely designed in such a way as to enhance employee quality of work life. Further, if the organization wanted to make tasks even more challenging, motivating, and meaningful, the nature of the organization would probably facilitate the required changes. On the other hand, a mechanistic unit (i.e., one in which workers are assigned to an assembly line) is likely to be perceived by some workers as exhibiting less flexibility and less emphasis on the acceptance of organizational change. If for some reason a leader in the organization wanted to introduce a work redesign effort, he or she would probably find that the mechanistic design constrained the available alternatives. More specifically, the organization itself would probably serve as a barrier to the effective redesign of tasks within it (14:150).

The Minuteman weapon system demands considerable attention to detail to ensure its continuous "on-alert" reliability. Additionally, the centralized nature of the maintenance production effort impacts the extent to which shop and team supervisors exercise autonomy over assignment of work priorities and decisions concerning when to start and stop work. The author concludes then, that missile

managers need to recognize that an "autonomy gap" may exist within the maintenance environment. Thus, managers should: (a) be particularly cognizant to grant additional authority and worker discretion to workers where it is possible, and (b) be fully prepared to explain arguments in favor of those organizational constraints which extend the safety and security of the existing missile force.

With respect to the work itself then, the study reveals that a comprehensive missile maintenance task redesign effort is not warranted at the present time; however, special emphasis should be given to widen the variety (in some instances) and autonomy experienced by technicians where it can be administered appropriately.

From the findings of Chapter IV and coverage of topics in the written response section of the survey, the contextual factors of the technicians' work seemed to contribute more to worker dissatisfaction than did the factors relating to the work itself. Certainly, complaining and soldiering have been companions since the first armies of antiquity opened their doors to boot camp, with foul-ups, supervision, living conditions, and inoperative equipment receiving their fair share of the dissent. That notwithstanding, the nature and extent of the written remarks returned may be indicative of more than simply "routine grousing" among the troops. The remarks fell roughly into six categories with respect to the realm of contextual

factors. They included pay, security, manning and conditions, location, supervisors, and cross-training. The following paragraphs discuss each of these and provide samples from the questionnaires.

The data for the analysis of pay satisfaction (contained in Table 25 of the previous chapter) speak for themselves; however, some specific comments provided by the subjects give a clearer picture of the reasoning behind the numbers:

> "The Air Force saw fit to delete our bonus for airmen between the years 6 - 14. This job isn't worth re-enlisting without the bonus. The hours are long, pay isn't enough, and it puts a burden on your family life. I think the Air Force made a big mistake [and] there's going to be alot of good men in this field getting out of the service."

> "We deal with nuclear weapons, dangerous chemicals, high falls and get no hazardous duty pay, no re-enlistment bonus, and no opportunity to take advantage of educational benefits."

> "I have no doubt in my mind that I would re-enlist if our career field offered a bonus! Everything else is great."

Closely related to the pay issue were security-related concerns. Several of these appeared to be of potential interest to managers:

> "The Air Force has brought too many cross-trainees into this career field [who] take away stripes from people competing for promotion."

> "There is very slow advancement, with extreme stagnation in the higher echelons of management."

Some of the comments tending to lower the overall perception of security satisfaction, however, came from

some who have set their sights not on an Air Force career, but rather on a career out of the realm of military service. For instance:

> "I didn't want to work in the missile field. I'm hoping to [obtain] a job skill I can use when I separate, to get a job out of the Air Force."
>
> "Where would this job leave me after 20 years. . . . There's not alot of missiles in peoples' back yards to be fixed."

A large block of respondents intimated that the manning levels were inadequate to properly perform the mission, given the conditions under which the work had to be performed. For example:

> "In our shop, the workload is twice the size of the working force and everyone is faced with 12-hour days."
>
> "The shifts are long, and we do not have enough people to cover the schedule."
>
> "We are manned at a level to support duty hours [as specified in Strategic Air Command regulations], but we really support 24 hours and seven days a week and are expected to do many duties [that] do not fall under what I would call maintenance."
>
> "Being in Periodic Maintenance for four years--four straight days in the field and nights--it doesn't do much for a marriage."
>
> "I feel there never was enough people in the Facilities Maintenance Team section. Sure, we still got the mission done with half the manning requirements, but what about morale and welfare?"
>
> "I am an Electro-Mechanical Team team chief running 14 to 17 dispatches per month at an average of 14 hours per dispatch . . . being subjected to extreme cold, extreme height (in the launch tube) plus long hours of travel to and from Launch Facilities and Launch Control Facilities. Then pile on all the extra classes that field runners are required to be at during off-duty days."

"The working conditions, such as the weather, the long hours (16+ hours), the vehicles we are receiving that are constantly breaking down, and the shop managers who have no sense of feelings for their technicians [are major factors in my decision]."

"The hours are too erratic and the working conditions are extremely hard."

A derivative of the working conditions issue raised here is the role that the geographical location played in technicians' intent to separate from the Air Force (tabulated results appear in Table 9 of Chapter IV). A few respondents were compelled to write that they liked the base and area they were stationed at, and would not like to move; however, the overwhelming majority expressed the opposite viewpoint for a variety of reasons including a noticeable lack of social satisfaction. They stated:

"The job I have allows me the opportunity to go to five other bases, all in the U.S.A. and all northern-tier ones."

"The people in the area have little or no respect for those in the Air Force."

"The weather is usually cold, the town is too small, and the geography of the area is flat and very [few] trees." [Author's note: Variations of this same theme were commonplace.]

"Advancement opportunity is not available within this community as far as education."

"Have you ever been stationed at Minot AFB [ND] for eight years and tried to get Permanent Change of Station (PCS) orders with no success?"

"I have only cold-region bases that I can otherwise go to. This AFSC needs to be a little more geographically flexible."

"I was in Minot, ND for four years and came to Ellsworth [AFB] SD!"

"I would like another career field in a warm southern climate. Note that I would really like to stay in for 20 years, but if I don't get a change of climate, I will not stay in."

The next category of comments relating to contextual factors could be loosely categorized as supervisory dissatisfaction. Many of the comments were rather cryptic and it was difficult in some cases to ascertain what level of supervision was actually being addressed. Technicians stated:

"I would like more positive comments from my supervisor on a good job being done."

"The way the section is being run and the unfairness of the way people are being treated here [is a major factor in my decision to separate]."

"If this organization was more people oriented, mission accomplishment would be more successful--people make the difference."

Lastly, about one-fifth of the comments regarding contextual factors bypassed altogether the conventional criticisms (such as pay, etc.) and focused on the dilemma caused by the apparent inability of individuals to cross-train out of their present AFSCs. Specialists noted:

"I entered 'open electronics' and was recruited into this job field."

"I'd like a chance to change AFSCs totally instead of being trapped in this one."

"Cross-training is very difficult if not impossible. It's very frustrating to be trapped in a critical career field or leave the Air Force."

Concluding this section are some other comments from missile technicians which help keep the focus of this study in perspective (particularly noting the 37 percent of the force sampled who expressed a definite intent to stay in):

> "This job is like a stepping stone. I've gained extensive knowledge in electronics . . . and am ready to move on to more challenging work [in the Air Force]."
>
> "The job position I hold is very rewarding."
>
> "The job location is fine, and I think I have given adequate support to my country for many years. . . . The Air Force has been good to me and I've done my best to return the favor. It's time to retire and try something new with the skills I've obtained."

The job characteristics model proposed by Hackman and Oldham does not present any specific implementing concepts to redress dissatisfaction in contextual work factors. As suggested earlier, organizational constraints serve to complicate broad-scale proposals which might lessen the burdens described here by laborers in the missile maintenance environment.

The author concludes that maintenance commanders will recognize that the pleas for relief contained in this study are certainly not new, and in some instances, the concerns may contain an element of overstatement. With the number of new systems entering the Air Force inventory and the relatively constant manpower pool, there are probably fewer career fields today which enjoy the luxury of a 40-hour work week than ever. However, the missile

maintenance environment, in particular, continues to be one that struggles with a lack of recognition for what can only be described as an awesome amount of work and responsibility that has been levied upon it. Leaders throughout the Strategic Air Command and at the Manpower Personnel Center need to retain the perspective that these are real people in the maintenance "trenches," with real concerns, facing pressures that just do not seem to get easier with the passage of time.

Undoubtedly, the ranks do contain some vestige of the "me-generation" thought pattern; however, the author's conclusion is that, by and large, the technicians are members of that band of warriors and wage-earners referred to recently by the Commander-in-Chief, President Reagan, as the "real heroes of America"--those willing to size up the task, set their hands to the plow, and see the job through to completion. It is the author's hope that missile maintenance commanders seize opportunities, when and where available, to help correct some of the shortfalls identified in this study and thereby lighten the load on the maintenance technicians--the backbone of the nuclear deterrent posture.

## Recommendations

The more applied issue of planning, implementing, and evaluating a task redesign program in the missile maintenance organizations is beyond the scope of this present

study. A follow-on investigation involving senior missile maintenance officers and senior enlisted advisors (Chief Master Sergeants) utilizing the Delphi Technique to combine ideas, eliminate policies that have been unsuccessful in the past, and recommend future actions could prove to be beneficial.

Additionally, investigation of the squadron level missile maintenance officers compared to operational missile officers may highlight factors affiliated with job satisfaction and career intent could enhance the understanding of the current Minuteman missile environment.

Finally, a replication of this study on a similar sample population at some point in the future may reveal trends among missile technicians. Since no baseline indices existed for missile maintenance technicians at the time of this study, the author could not state objectively that those surveyed were satisfied or dissatisfied with their jobs. Only statements relative to the national norm were possible. Despite changing environmental and operational factors, future replications of this study using various sample populations (such as enlisted Peacekeeper missile maintenance specialists) provide definitive statements regarding job satisfaction by comparing the results to those contained in this study. Adding regression analyses to the methodology of future replications would

likely contribute useful information by determining which variables significantly affect career intent.

## Summary

This chapter concludes the study by bringing together the analytic results from Chapter IV and the more subjective responses from the open-ended portion of the questionnaire to arrive at answers to the stated research questions. This research project is not intended as an end in itself, but should be considered as part of an ongoing effort to better understand the missile maintenance environment, and so more effectively command its forces.

## Appendix A: Operationalizing the Job Characteristics Theory

Translating the job characteristics model from the abstract into managerial practice usually involves the use of the Job Diagnostic Survey (JDS). The two primary purposes served by the JDS are to provide a diagnosis of existing jobs prior to initiating any planned task redesign efforts and to evaluate the effects of such task redesign efforts (14:40). In this study, only the diagnosis of existing jobs was performed.

Once target jobs for redesign efforts have been determined (based on an analysis of the MPS), the next step in operationalizing the job characteristics theory is to redesign the tasks according to five action principles. These principles are: (1) form natural work units, (2) combine tasks, (3) establish client relationships, (4) vertical loading, and (5) opening feedback channels (14:40). Figure 9 depicts how each of these principles is seen as influencing or enhancing each of the five core job characteristics.

The implementing concepts are directly tied to the diagnostic tools; the output of the diagnosic activity specifies which action steps are likely to have the greatest impact in a given scenario (20:61).

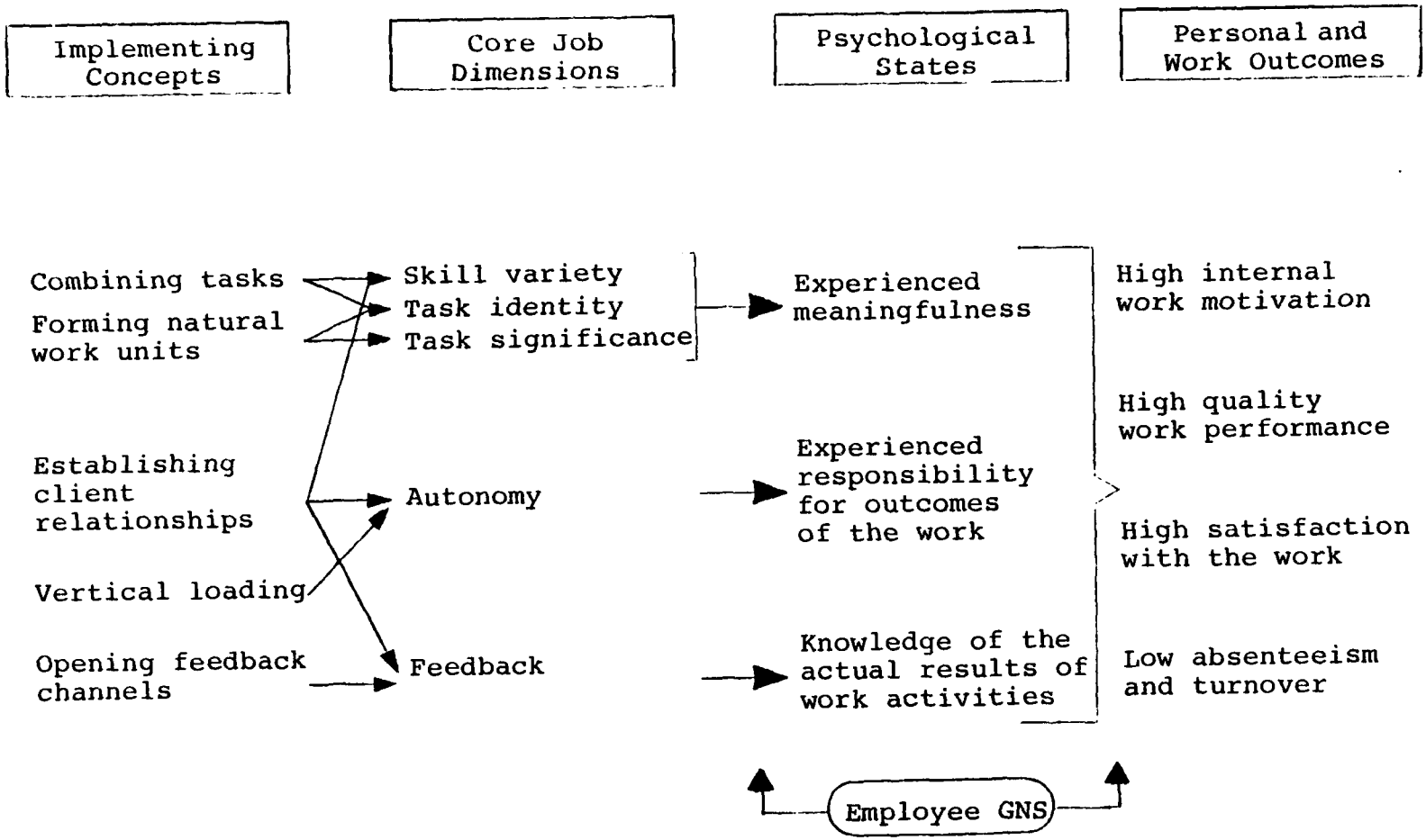



Fig. 9. Operationalizing the Job Characteristics Theory (14:42)

After completing the diagnosis of a job, a researcher should know which of the core dimensions of a job most needed remedial attention. The researcher at this point could examine Figure 9 and select those implementing concepts that deal directly with the more problematic aspects of the existing job. The implementing concepts are briefly discussed below.

1. Forming natural work units. In many cases, the cluster of tasks a worker performs during a typical week includes a high degree of randomness, leaving the worker somewhat confused as to what he has actually contributed to the organization. The principle underlying natural unit of work is "ownership"--a worker's sense of continuing responsibility for a specific and identifiable body of work. Creating natural work units involves two steps. First, an identification of the basic work items must occur. Second, the items must be grouped into natural categories. The ownership fostered by natural units of work can make the difference between a feeling that the work is rewarding and has intrinsic worth and the feeling that it is irrelevant and boring. As Figure 9 depicts, task identity and task significance become enhanced as a direct outcome of forming natural units of work (20:64).

2. Combining tasks. The principle of combining tasks suggests that whenever possible, existing tasks should be put together to form new and larger modules of work.

Since the turn of the century, "scientific management" has espoused the fractionalization of jobs with the accompanying justification given in terms of efficiency, as measured by either low costs or some applicable time-and-motion study data. Unfortunately, there were some hidden costs (such as withdrawal behavior) to such highly fractionalized jobs. Task combination, however (like natural units of work), expands the task identity of the job. Moreover, the more tasks that are combined into a single worker's job, the greater the variety of skills he must utilize in accomplishing the job. Thus, task combination also leads directly to greater skill variety. Figure 9 reveals this linkage. Note also that some tasks, if combined into a large body of related work, would be more than an individual could reasonably handle. In these instances, it may be advantageous to assign the new, larger task to a small team of workers--who are given greater autonomy for its completion (20:64).

3. Establishing client relationships. In an effort to limit the instances in which a worker has little or no contact with (or even awareness of) the ultimate user of his or her product or service, a three-step process of creating client relationships is useful. First the client must be identified. Next, the most direct manner of contact possible (and practical) must be established between the worker and that client. Third, criteria

must be set up such that the client is able to judge the quality of the product or service received. By encouraging this type of relationship, improvements can often be realized on three of the core dimensions. Skill variety often increases, because of the development of the interpersonal skills necessary to maintain the client relationship. Autonomy can increase because the worker is usually given personal responsibility for deciding how to manage his relationships with the clients. Feedback increases, because the avenue exists whereby praise and/or criticism of the individual's work outputs may be directly given (20:64).

4. Vertical loading. In vertical loading, the intent of job redesigners is to partially close the gap between the "doing" and the "controlling and planning" parts of the job in an effort to reap some motivational advantages. Responsibilities and controls that were the exclusive property of higher levels of management are filtered down into a vertically loaded job. When a job becomes vertically loaded, it consequently increases in autonomy. This added autonomy (as shown in Figure 9) will also enhance the feeling of personal responsibility for the work, and will ultimately lead to higher internal work motivation (20:64-65).

5. Opening feedback channels. Generally, it is better for a worker to learn about performance directly as

the job is performed rather than from management on an occasional basis (due in part to the inferior nature of many supervisors' "appraisal sessions"). Job-provided feedback is more immediate and private than supervisor-supplied feedback, and it increases the individual's feelings of personal control over the work. Exactly what should be done to open channels of job-provided feedback varies from job to job, yet may simply involve removing existing blocks that serve to isolate the worker from naturally occurring data about performance. Adjusting overly-restrictive quality control efforts and transmitting downward (as well as upward) records concerning employee performance are two examples (20:65). Workers, as a result, may place more emphasis on improving their performance, much the same as when forward observers transmit burst coordinates back to artillery gunners to improve firing accuracy.

Based on the job enrichment theory, the action steps discussed above prescribe in concrete terms what to do to make jobs more motivating for the people who perform them.

## Appendix B: Methodological Design of Research Hypotheses Tested

The research questions, along with the specific hypotheses proposed in this study, are listed below. The actual comparative testing and the outcomes appear in Chapter IV.

1. Determine if any of the selected AFSCs exhibit low job satisfaction or low motivation.

> Hypothesis 1: The degree of job satisfaction perceived by enlisted missile maintenance technicians does not differ in the 411X0, 411X1, and 411X2 career fields, and is the same as the national norm.
>
> Hypothesis 2: The degree f internal work motivation perceived by enlisted missile maintenance technicians is the same throughout the three career fields and is the same as the national norm.
>
> Hypothesis 3: The degree of growth satisfaction perceived by enlisted missile maintenance technicians is the same throughout the three career fields, but is collectively lower than the national norm.

2. Determine if any of the selected AFSCs are low in motivating potential.

> Hypothesis 4: The MPS of each career field and the combined maintenance technicians' MPS is significantly higher than the national norm, but the career fields do not vary among themselves.

3. If the AFSC is rated as low in motivating potential or job satisfaction, determine what specific aspects are causing the difficulty.

Hypothesis 5: The degree to which a job requires the worker to perform activities which challenge his skills and abilities (skill variety) is significantly higher for the Facility Maintenance Specialists (411X2), in particular, and for the combined maintenance technicians overall.

Hypothesis 6: Jobs performed by the 411X0, 411X1, and 411X2 career fields are collectively higher in task identity than the national norm; additionally, the Missile Maintenance Specialist AFSC (411X1) mean score for task identity is higher than that of the national norm.

Hypothesis 7: The task significance indicated by specialists from all three career fields is comparatively higher than the national norm when grouped together and individually; however, they do not vary among themselves.

Hypothesis 8: The evidence of autonomy in jobs performed by workers in the three AFSCs, both individually and collectively, is the same as the national norm and does not vary from one AFSC to another.

Hypothesis 9: The degree of feedback from the job is lower for jobs performed by the three career fields sampled than is present in jobs measured by the national norm, and does not vary among the AFSCs.

Hypothesis 10: The degree of feedback from agents does not vary from career field to career field, and does not vary from the national norm.

Hypothesis 11: The extent to which the three career fields deal with others is above the national norm, both individually and collectively, and the three career fields do not vary among themselves.

Hypothesis 12: The pay satisfaction of the three career fields, both individually and collectively, is below the national norm, but does not differ from one career field to another.

Hypothesis 13: The technicians' satisfaction with their overall job security is higher than that of the national norm, and does not differ from one AFSC to another.

Hypothesis 14: The social satisfaction of personnel assigned to the three AFSCs studied, both individually and collectively, is below that of the national norm, but does not vary among career fields.

Hypothesis 15: The supervisory satisfaction of the three career fields, both individually and collectively, does not differ from the national norm, nor does it differ among the career fields.

4. Analyze the selected AFSCs to ascertain how "ready" the technicians are for job redesign.

Hypothesis 16: The growth need strength of the Systems Analyst, Missile Maintenance, and Missile Facilities specialists is singularly and collectively higher than that of the national norm, and is not significantly different for any one AFSC.

RESEARCH HYPOTHESES TESTED (MATRIX FORMAT)*

| Construct | Combined | 411X0 | 411X1 | 411X2 |
|---|---|---|---|---|
| Affective Outcomes | | | | |
| Job Satisfaction | --- | --- | --- | --- |
| Internal Work Motivation | --- | --- | --- | --- |
| Growth Satisfaction | Low | Low | Low | Low |
| Summary Measure | | | | |
| MPS | High | Low | High | High |
| Job Characteristics | | | | |
| Skill Variety | High | -- | --- | High |
| Task Identity | High | --- | High | --- |
| Task Significance | High | High | High | High |
| Autonomy | --- | --- | --- | --- |
| Feedback (Job) | Low | Low | Low | Low |
| Feedback (Agents) | --- | --- | --- | --- |
| Dealing with Others | High | High | High | High |
| Context Satisfactions | | | | |
| Pay Satisfaction | Low | Low | Low | Low |
| Security Satisfaction | High | High | High | High |
| Social Satisfaction | Low | Low | Low | Low |
| Supervisory Satisfaction | --- | --- | --- | --- |
| Desire for Change | | | | |
| GNS | High | High | High | High |

*Note: The relationships hypothesized for the listed constructs are between the AFSCs and the national norm (the individual scores for which appear in Appendix E). All relationships among the AFSCs are hypothesized not to significantly differ.

DEPARTMENT OF THE AIR FORCE
AIR FORCE INSTITUTE OF TECHNOLOGY (AU)
WRIGHT-PATTERSON AIR FORCE BASE, OH 45433

Appendix C: Research Questionnaire

6 MAY 1985

ATTN: LS (Capt C. Price, AUTOVON 785-7212)

SUBJ: Research Questionnaire

1. Please take the time to complete the attached questionnaire and return in the enclosed envelope within one week.

2. This questionnaire is being used to help you identify aspects of your job that may allow it to become better designed in the future. The survey data measures your perceptions and attitudes toward your job and job environment. Each of the six sections contains specific instructions at the top. Please read them carefully and answer all the questions as honestly as you can. Your individual responses will be combined with others and will be held in the strictest confidence; no one in your organization will be permitted access to answers attributed to you personally.

3. Your participation is completely voluntary, but we would certainly appreciate your help.

Larry L. Smith

LARRY L. SMITH, Colonel, USAF
Dean
School of Systems and Logistics

2 Atch
1. Questionnaire
2. Return Envelope

USAF Survey Control No. 85-35

SECTION ONE

This part of the questionnaire asks you to describe your job, as objectively as you can.

Please do not use this part of the questionnaire to show how much you like or dislike your job. Questions about that will come later. Instead, try to make your descriptions as accurate and as objective as you possibly can.

A sample question is given below.

A. To what extent does your job require you to work with mechanical equipment?

1--------2--------3--------4--------5--------(6)--------7

Very little; the job requires almost no contact with mechanical equipment of any kind.

Moderately

Very much; the job requires almost constant work with mechanical equipment.

You are to circle the number which is the most accurate description of your job.

If, for example, your job requires you to work with mechanical equipment a good deal of the time--but also requires some paperwork--you might circle the number six, as was done in the example above.

Please turn the page and begin.

1. To what extent does your job require you to work closely with other people (either clients, or people in related jobs in your own organization)?

1--------2--------3--------4--------5--------6--------7

| | | |
|---|---|---|
| Very little; dealing with other people is not at all necessary in doing the job. | Moderately; some dealing with others is necessary. | Very much; dealing with other people is an absolutely essential and crucial part of doing the job. |

2. How much autonomy is there in your job? That is, to what extent does your job permit you to decide on your own how to go about doing the work?

1--------2--------3--------4--------5--------6--------7

| | | |
|---|---|---|
| Very little; the job gives me almost no personal "say" about how and when the work is done. | Moderate autonomy; many things are standardized and not under my control, but I can make some decisions about the work. | Very much; the job gives me almost complete responsibility for deciding how and when the work is done. |

3. To what extent does your job involve doing a "whole" and identifiable piece of work? That is, is the job a complete piece of work that has an obvious beginning and end? Or is it only a small part of the overall piece of work, which is finished by other people or by automatic machines?

1--------2--------3--------4--------5--------6--------7

| | | |
|---|---|---|
| My job is only a tiny part of the overall piece of work; the results cannot be seen in the final product or service. | My job is a moderate-sized "chunk" of the overall piece of work; my own contribution can be seen in the final outcome. | My job involves doing the whole piece of work, from start to finish; the results of my activities are easily seen in the final product or service. |

4. How much variety is there in your job? That is, to what extent does the job require you to do many different things at work, using a variety of your skills and talents?

1--------2--------3--------4--------5--------6--------7

| | | |
|---|---|---|
| Very little; the job requires me to do the same routine things over and over again. | Moderate variety. | Very much; the job requires me to do many different things, using a number of different skills and talents. |

5. In general, how significant or important is your job? That is, are the results of your work likely to significantly affect the lives or well-being of other people?

1--------2--------3--------4--------5--------6--------7

| | | |
|---|---|---|
| Not very significant; the outcomes of my work are not likely to have important effects on other people. | Moderately significant. | Highly significant; the outcomes of my work can affect other people in very important ways. |

6. To what extent do managers or co-workers let you know how well you are doing on your job?

1--------2--------3--------4--------5--------6--------7

| | | |
|---|---|---|
| Very little; people almost never let me know how well I am doing. | Moderately; sometimes people may give me "feedback;" other times they may not. | Very much; managers or co-workers provide me with almost constant "feedback" about how well I am doing. |

7. To what extent does doing the job itself provide you with information about your work performance? That is, does the actual work itself provide clues about how well you are doing--aside from any "feedback" co-workers or supervisors may provide?

1--------2--------3--------4--------5--------6--------7

| | | |
|---|---|---|
| Very little; the job itself is set up so I could work forever without finding out how well I am doing. | Moderately; sometimes doing the job provides "feedback" to me; sometimes it does not. | Very much; the job is set up so that I get almost constant "feedback" as I work about how well I am doing. |

SECTION TWO

Listed below are a number of statements which could be used to describe a job.

You are to indicate whether each statement is an accurate or inaccurate description of your job.

Once again, please try to be as objective as you can in deciding how accurately each statement describes your job--regardless of whether you like or dislike your job.

Write a number in the blank beside each statement, based on the following scale:

How accurate is the statement in describing your job?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Very Inaccurate | Mostly Inaccurate | Slightly Inaccurate | Uncertain | Slightly Accurate | Mostly Accurate | Very Accurate |

____ 1. The job requires me to use a number of complex or high-level skills.

____ 2. The job requires a lot of cooperative work with other people.

____ 3. The job is arranged so that I do not have the chance to do an entire piece of work from beginning to end.

____ 4. Just doing the work required by the job provides many chances for me to figure out how well I am doing.

____ 5. The job is quite simple and repetitive.

____ 6. The job can be done adequately by a person working alone--without talking or checking with other people.

____ 7. The supervisors and co-workers on this job almost never give me any "feedback" about how well I am doing in my work.

____ 8. This job is one where a lot of other people can be affected by how well the work gets done.

____ 9. The job denies me any chance to use my personal initiative or judgment in carrying out the work.

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Very Inaccurate | Mostly Inaccurate | Slightly Inaccurate | Uncertain | Slightly Accurate | Mostly Accurate | Very Accurate |

____ 10. Supervisors often let me know how well they think I am performing the job.

____ 11. The job provides me the chance to completely finish the pieces of work I begin.

____ 12. The job itself provides very few clues about whether or not I am performing well.

____ 13. The job gives me considerable opportunity for independence and freedom in how I do the work.

____ 14. The job itself is <u>not</u> very significant or important in the broader scheme of things.

SECTION THREE

Now please indicate how you personally feel about your job.

Each of the statements below is something that a person might say about his or her job. You are to indicate your own, personal feelings about your job by marking how much you agree with each of the statements.

Write a number in the blank for each statement, based on this scale:

How much do you agree with the statement?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Disagree Strongly | Disagree | Disagree Slightly | Neutral | Agree Slightly | Agree | Agree Strongly |

____ 1. My opinion of myself goes up when I do this job well.

____ 2. Generally speaking, I am very satisfied with this job.

____ 3. I feel a great sense of personal satisfaction when I do this job well.

____ 4. I frequently think of quitting this job.

____ 5. I feel bad and unhappy when I discover that I have performed poorly on this job.

____ 6. I am generally satisfied with the kind of work I do in this job.

____ 7. My own feelings generally are not affected much one way or the other by how well I do on this job.

SECTION FOUR

Now please indicate how satisfied you are with each aspect of your job listed below. Once again, write the appropriate number in the blank beside each statement.

How satisfied are you with this aspect of your job?

| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|---|---|---|---|---|---|---|
| Extremely Dis-satisfied | Dis-satisfied | Slightly Dis-satisfied | Neutral | Slightly Satisfied | Satisfied | Extremely Satisfied |

____ 1. The amount of job security I have.

____ 2. The amount of pay and fringe benefits I receive.

____ 3. The amount of personal growth and development I get in doing my job.

____ 4. The people I talk to and work with on my job.

____ 5. The degree of respect and fair treatment I receive from my boss.

____ 6. The feeling of worthwhile accomplishment I get from doing my job.

____ 7. The chance to get to know other people while on the job.

____ 8. The amount of support and guidance I receive from my supervisor.

____ 9. The degree to which I am fairly paid for what I contribute to this organization.

____ 10. The amount of independent thought and action I can exercise in my job.

____ 11. How secure things look for me in the future in this organization.

____ 12. The chance to help other people while at work.

____ 13. The amount of challenge in my job.

____ 14. The overall quality of the supervision I receive in my work.

SECTION FIVE

Listed below are a number of characteristics which could be present on any job. People differ about how much they would like to have each one present in their own jobs. We are interested in learning how much you personally would like to have each one present in your job.

Using the scale below, please indicate the degree to which you would like to have each characteristic present in your job.

NOTE: The numbers on this scale are different from those used in previous scales.

| 4 | 5 | 6 | 7 | 8 | 9 | 10 |
|---|---|---|---|---|---|---|
| Would like having this only a moderate amount (or less) | | | Would like having this very much | | | Would like having this extremely much |

____ 1. High respect and fair treatment from my supervisor.

____ 2. Stimulating and challenging work.

____ 3. Chances to exercise independent thought and action in my job.

____ 4. Great job security.

____ 5. Very friendly co-workers.

____ 6. Opportunities to learn new things from my work.

____ 7. High salary and good fringe benefits.

____ 8. Opportunities to be creative and imaginative in my work.

____ 9. Quick promotions.

____ 10. Opportunities for personal growth and development in my job.

____ 11. A sense of worthwhile accomplishment in my work.

SECTION SIX

BIOGRAPHICAL DATA

All information provided in this section will be held in the strictest confidence; absolutely no one in your organization will be permitted access to individual responses.

1. What is your organizational identifier? (Check one)

   A. ____ OMMS
   B. ____ FMMS
   C. ____ Other (please specify _____)

2. What is your current specialty code (AFSC)? (Check one)

   A. ____ AFSC 316X0 (411X0)
   B. ____ AFSC 443X0 (411X1)
   C. ____ AFSC 445X0 (411X2)
   D. ____ Other (please specify) _____)

3. What is your skill level in your current job specialty?

   A. ____ 3 Level
   B. ____ 5 Level
   C. ____ 7 Level
   D. ____ 9 Level

4. What is your present active duty grade? (Check one)

   A. ____ E-1
   B. ____ E-2
   C. ____ E-3
   D. ____ E-4
   E. ____ E-5
   F. ____ E-6
   G. ____ E-7
   H. ____ E-8
   I. ____ E-9

5. Have you worked in your present career field throughout your Air Force career?

   A. ____ Yes
   B. ____ No

   If no, how long have you worked in your present career field?

   A. ____ Less than one year
   B. ____ 1-4 years
   C. ____ 5-8 years
   D. ____ 9-12 years
   E. ____ Over 12 years

6. Do you supervise others?

A. ____ Yes B. ____ No

If yes, how many personnel do you supervise? (Check one)

A. ____ Less than 5 personnel
B. ____ 6-10 personnel
C. ____ 11-15 personnel
D. ____ 16-20 personnel
E. ____ Over 20 personnel

7. If a member of OMMS, to which work team center do you currently belong?

A. ____ Missile Maintenance
B. ____ Missile Handling
C. ____ Electro-Mechanical
D. ____ Combat Targeting
E. ____ Other (please specify _____)

8. If a member of FMMS, to which work team center do you currently belong?

A. ____ Shop Maintenance
B. ____ Facility Maintenance
C. ____ Vehicle and Equipment Control
D. ____ Other (please specify _____)

9. Do you intend to stay in the Air Force beyond your present commitment? (Check one)

A. ____ No, I am separating
B. ____ No, I am retiring
C. ____ Undecided
D. ____ Yes

If your answer is NO or UNDECIDED, please answer the following two questions:

10. Is your present job location a major factor in your decision?

A. ____ Yes B. ____ No

If yes, in what way?

_____

_____

_____

11. Is your present job a major factor in your decision?

A. ____ Yes B. ____ No

If yes, in what way? Your comments will be quite helpful in making any recommendations for change found appropriate by this study.

_____

_____

_____

_____

_____

## Appendix D: Scoring Key for the Short Form of the Job Diagnostic Survey (17:303-306)

The Short Form of the Job Diagnostic Survey(JDS) measures several characteristics of jobs, the reactions of the respondents to their jobs, and the growth need strength of the respondents. Some of the scales tapped by the JDS are not included in the Short Form; others are measured with fewer items. The scales measuring the objective job dimensions are, however, identical with those in the JDS.

Each variable measured by the JDS Short Form is listed below, along with (a) a one or two sentence description of the variable, and (b) a list of the questionnaire items which are averaged to yield a summary score for the variable.

* * * *

I. JOB DIMENSIONS: Objective characteristics of the job itself.

A. Skill Variety: The degree to which a job requires a variety of different activities in carrying out the work, which involves the use of a number of different skills and talents of the employee.

Average the following items:

Section One #4
Section Two #1
#5 (reversed scoring--i.e., subtract the number entered by the respondent from 8)

B. Task Identity: The degree to which the job requires the completion of a "whole" and identifiable piece of work--i.e., doing a job from beginning to end with a visible outcome.

Average the following items:

Section One #3
Section Two #11
#3 (reversed scoring)

C. Task Significance: The degree to which the job has a substantial impact on the lives or work of other people--whether in the immediate organization or in the external environment.

Average the following items:

Section One #5
Section Two #8
#14 (reversed scoring)

D. Autonomy: The degree to which the job provides substantial freedom, independence, and discretion to the employee in scheduling his work and in determining the procedures to be used in carrying it out.

Average the following items:

Section One #2
Section Two #13
#9 (reversed scoring)

E. Feedback from the Job Itself: The degree to which carrying out the work activities required by the job results in the employee obtaining information about the effectiveness of his or her performance.

Average the following items:

Section One #7
Section Two #4
#12 (reversed scoring)

F. Feedback from Agents: The degree to which the employee receives information about his or her performance effectiveness from supervisors or from co-workers. (This construct is not a job characteristic per se, and is included only to provide information supplementary to construct (E) above.)

Average the following items:

Section One #6
Section Two #10
#7 (reversed scoring)

G. Dealing with Others: The degree to which the job requires the employee to work closely with other people (whether other organization members or organizational "clients").

Average the following items:

| | |
|---|---|
| Section One | #1 |
| Section Two | #2 |
| | #6 (reversed scoring) |

II. AFFECTIVE RESPONSES TO THE JOB: The private, affective reactions or feelings an employee gets from working on his job.

A. General Satisfaction: An overall measure of the degree to which the employee is satisfied and happy in his or her work.

Average the following items:

| | |
|---|---|
| Section Three | #2 |
| | #6 |
| | #4 (reversed scoring) |

B. Internal Work Motivation: The degree to which the employee is self-motivated to perform effectively on the job.

Average the following items:

| | |
|---|---|
| Section Three | #1 |
| | #3 |
| | #5 |
| | #7 (reversed scoring) |

C. Specific Satisfaction:* These short scales tap several specific aspects of the employee's job satisfaction.

C1. "Pay" satisfaction. Average items #2 and #9 of Section Four.
C2. "Security" satisfaction. Average items #1 and #11 of Section Four.
C3. "Social" satisfaction. Average items #4, #7, and #12 of Section Four.
C4. "Supervisory" satisfaction. Average items #5, #8, and #14 of Section Four.
C5. "Growth" satisfaction. Average items #3, #6, #10, and #13 of Section Four.

III. INDIVIDUAL GROWTH NEED STRENGTH: This scale taps the degree to which an employee has strong vs. weak desire to obtain "growth" satisfactions from his or her work.

Average the six items from Section Five listed below. Before averaging, subtract 3 from each item score; this will result in a summary scale ranging from one to seven. The items are: #2, #3, #6, #8, #10, and #11.

IV. MOTIVATING POTENTIAL SCORE: A score reflecting the potential of a job for eliciting positive internal work motivation on the part of employees (especially those with high degree for growth need satisfaction) is given below.

$$MPS = \left[\frac{\text{Skill Variety} + \text{Task Identity} + \text{Task Significance}}{3}\right] \times \text{Autonomy} \times \text{Feedback from the Job}$$

## Appendix E: Job Diagnostic Survey Reliabilities, Validity, and Means (National Norm)

A number of standardized instruments have appeared in the literature which attempt to measure attitudes such as job satisfaction; to date the Job Diagnostic Survey (JDS) is the most widely used perceptual measure of task design (37:93). The JDS was specifically designed by J. Richard Hackman and Greg Oldham to measure each of the variables in the job characteristics model based on data obtained from 658 employees working on 62 different jobs in seven organizations. Both service and industrial organizations are included in the sample, but all are business organizations (18:259). Properties of the JDS (including means, standard deviations, description of item content and format, reliabilities, and intercorrelations) are further described in Development of the Job Diagnostic Survey (19), and in The job diagnostic survey: An instrument for the diagnosis of jobs and the evaluation of job redesign projects, Department of Administrative Sciences, Yale University, (Tech Rep No. 4), 1974, by J. Richard Hackman and Greg Oldham.

Reliability may be thought of as the extent to which a standardized measurement is repeatable. Table 30 presents the internal consistency reliabilities of each of the

TABLE 30

RELIABILITIES OF THE JDS SCALES (15:175)

| JDS Scale | Internal Consistency Reliability | Median Off-diagonal Correlation[a] |
|---|---|---|
| **Job Dimensions** | | |
| Skill Variety | .71 | .19 |
| Task Identity | .59 | .12 |
| Task Significance | .66 | .14 |
| Autonomy | .66 | .19 |
| Feedback from the Job Itself | .71 | .19 |
| Feedback from Agents | .78 | .15 |
| Dealing with Others | .59 | .15 |
| **Psychological States** | | |
| Experienced Meaningfulness of the Work | .74 | .26 |
| Experienced Responsibility for the Work | .72 | .23 |
| Knowledge of Results | .76 | .17 |

Notes:

[a]The median off-diagonal correlation is the median correlation of the items scored on a given scale with all the items scored on different scales of the same type of variable. Thus, the median off-diagonal correlation for skill variety (.19) is the median correlation of all items measuring skill variety with all the items measuring the other six job dimensions.

TABLE 30--Continued

| JDS Scale | Internal Consistency Reliability | Median Off-diagonal Correlation[a] |
|---|---|---|
| **Affective Responses to the Job** | | |
| General Satisfaction | .76 | .25 |
| Internal Work Motivation | .76 | .25 |
| Specific Satisfactions | | |
| Job Security[b] | --- | --- |
| Pay[b] | --- | --- |
| Social | .56 | .23 |
| Supervisory | .79 | .25 |
| Growth | .84 | .28 |
| **Growth Need Strength** | | |
| "Would Like" Format[c] | .88 | --- |
| Job Choice Format[c] | .71 | --- |

[b]These scales are added to the JDS after the present data were collected, and no reliability data are yet available.

[c]Off-diagonal correlations are not reported for these two scales, since all items were designed to tap the same construct. The scale scores obtained using the "would like" format correlate .50 with the scale scales obtained using the job choice format.

scales measured by the JDS as well as the median correlations (which provide an indication of the discriminant validity of the items). Generally, these results suggest that both the internal consistency reliability of the scales and the discriminant validity of the items are satisfactory (19:164).

Validity of a sampling instrument, on the other hand, may be defined as the extent to which a measurement is accurate. The substantive validity of the Job Diagnostic Survey shows that the variables measured relate to one another (and to external criterion variables) generally as predicted by the theory on which the instrument is based (19:166-7).

Means and standard deviations of the JDS scale scores used in this study appear at the end of this appendix. The author felt that more useful scale scores might have been produced by combining appropriate job families (such as bench work, service, and structural work) from Appendix E of Work Redesign (17:317). However, correspondence with both Dr. Hackman and Dr. Oldham in May 1985 revealed that the data on the exact number of respondents for each job category was not available (only the number of jobs representing each category could be obtained), and thus, the statistical analysis described in Chapter III of this study was not possible.

In summary, the published results provide generally strong support for the validity of the job characteristics model; the available empirical research suggests that task design often has a positive relationship with various worker responses (37:93). Hackman and Oldham admit that although the present boundaries of task design-response relationships have not yet been fully discerned, the JDS (having undergone three major revisions) remains highly satisfactory in terms of the reliabilities of component scales (15:173).

JOB DIAGNOSTIC SURVEY NATIONAL NORMS
NON-MANAGERIAL WORKERS (10:57)

| JOB CHARACTERISTICS | MEAN | STD DEV |
|---|---|---|
| Skill Variety | 4.30 | 1.28 |
| Task Identity | 4.65 | 1.24 |
| Task Significance | 5.39 | 1.15 |
| Autonomy | 4.61 | 1.24 |
| Feedback from Job | 4.70 | 1.23 |
| Feedback from Agents | 3.97 | 1.39 |
| Dealing with Others | 5.23 | 1.10 |
| CRITICAL PSYCHOLOGICAL STATES | | |
| Experienced Meaningfulness | 5.00 | .99 |
| Experienced Responsibility | 5.33 | .86 |
| Knowledge of Results | 4.99 | 1.06 |
| AFFECTIVE OUTCOMES | | |
| General Satisfaction | 4.58 | 1.08 |
| Growth Satisfaction | 4.63 | 1.19 |
| Internal Work Motivation | 5.47 | .81 |
| CONTEXT SATISFACTIONS | | |
| Job Security | 4.71 | 1.21 |
| Pay | 4.16 | 1.42 |
| Co-workers | 5.25 | .96 |
| Supervision | 4.82 | 1.39 |
| INDIVIDUAL GROWTH NEED STRENGTH | 5.57 | 1.12 |
| MOTIVATING POTENTIAL SCORE (MPS) | 113.38 | 60.00 |

Note: These norms were compiled by Hackman, Oldham, and Stepina. They are based on the responses of 500 employees who work in non-managerial positions.

## Bibliography


1. Bailey, W. P. and others. Human Factors Aspects of the Minuteman Wing III Launch Complex Extended Survival Test--VAFB. Research Report D2-15882-1. The Boeing Company, Seattle WA, August 1964 (AD-A447 720).

2. Brief, Arthur P. and Ramon J. Aldag. "Employee Reactions to Job Characteristics: A Constructive Replication," Journal of Applied Psychology, 60: 182-186 (1975).

3. Campbell, Capt Parnell M. and Robert M. Gallagher. Analysis of the Technical Training of Enlisted Minuteman Missile Maintenance Personnel. MS thesis, LSSR 8-84. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1984.

4. Campbell, Wendy. Air Force Human Resources Laboratory, Wright-Patterson AFB OH. Personal interviews. January 1985.

5. Chenzoff, Andrew P. and others. Analysis to Improve the Maintenance Environment: A View from Active Duty Maintenance Personnel. Research Report AFHRL TR 83-60. Air Force Human Resources Laboratory, Logistics and Human Factors Division, Wright-Patterson AFB OH, June 1984.

6. Christopher, Rachelle G. and Edward E. Christopher. Job Enrichment: How Far Have We Come? Washington: University Press of America, Inc., 1979.

7. Cooley, Lt Col David A. Chief, Directorate of Missile Maintenance, Management Division, SAC Headquarters, Offutt AFB NE. Telephone interview. 6 February 1985.

8. Dunn, Capt John T. and Capt John P. Feiler. A Model of United States Air Force Turnover. MS thesis, LSSR 98-83. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1983 (AD-A135 597).

9. Fancher, Capt Samuel W. A Qualitative Analysis of Supervision in SAC Minuteman ICBM Maintenance. MS thesis, LSSR 112-83. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1983 (AD-A135 599).

10. Flynn, Capt Collin F. An Application of the Job Characteristics Model to Selected Strategic Air Command Aircraft Maintenance Career Fields. MS thesis, LSSR 17-83. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1983 (AD-A134 337).

11. Ford, R. N. Motivation Through the Work Itself. New York: AMA, 1969.

12. Gantz, Lt Col Kenneth F., ed. The United States Air Force Report on the Ballistic Missile. Garden City: Doubleday & Company, Inc., 1958.

13. Gates, Ed. "The Other Side of Retention: Those Who Return," Air Force Magazine, January 1980.

14. Griffin, Ricky W. Task Design An Integrative Approach. Glenview IL: Scott, Foresman and Company, 1982.

15. Guthrie, Capt Walter J. A Study of Job Characteristics and Job Attitudes at a Tactical Air Command Fighter Aircraft Maintenance Complex. MS thesis, AFIT/GSM/SM/77S-5. School of Engineering, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, 1977 (AD-A045 998).

16. Hackman, J. Richard and Edwin E. Lawler III. "Employee Reactions to Job Characteristics," Journal of Applied Psychology [Monograph], 259-286, June 1971.

17. Hackman, J. Richard and Greg R. Oldham. Work Redesign. Reading MA: Addison-Wesley Publishing Company, 1980.

18. -----. "Motivation Through the Design of Work: Test of a Theory," Organizational Behavior and Human Performance, 250-279, August 1976.

19. -----. "Development of the Job Diagnostic Survey," Journal of Applied Psychology, 60: 159-170 (1975).

20. Hackman, J. Richard and others. "A New Strategy for Job Enrichment," California Management Review, 57-71, Summer 1975.

21. Herzberg, Frederick. "One More Time: How Do You Motivate Employees?" Harvard Business Review, 53-62, January-February 1968.

22. Herzberg, Frederick, Bernard Mausner and Barbera B. Snyderman. The Motivation to Work (Second Edition). New York: John Wiley & Sons, Inc., 1959.

23. Herzberg, Frederick and Edmund A. Rafalko. "Job Enrichment Pays Off Again and Again, An American Answer to a Swedish Experiment." Washington: SAF/OIS, May 30, 1975.

24. Hulin, Charles L. and Milton R. Blood. "Job Enlargement, Individual Differences, and Worker Responses," Psychological Bulletin, 69: 41-55 (1968).

25. Kuenning, Capt Thomas E., Jr. and Maj Robert O. Mattson. Personnel Motivation--The Key to Minuteman System Effectiveness. Air Command and Staff College Research Study 1600-76. Air University, Maxwell AFB AL, May 1976.

26. Ley, Willy. Rockets, Missiles and Men in Space. New York: The Viking Press, 1968.

27. Locke, Edwin A. and others. "An Experimental Case Study of Successes and Failures of Job Enrichment in a Government Agency," Journal of Applied Psychology, 61: 701-711 (1976).

28. Longnecker, Justin G. Principles of Management and Organizational Behavior (Fourth Edition). Columbus OH: Charles E. Merrill Publishing Company, 1977.

29. Maze, Rick. "SecDef: 3% July Raise, Then 15-Month Freeze," Air Force Times, 1,4, December 31, 1984.

30. McClave, James T. and P. George Benson. Statistics for Business and Economics (Second Edition). Santa Clara: Dellen Publishing Company, 1982.

31. McDaniel, Capt William Thomas and Capt John R. Dodd. Minuteman Combat Crew Integrity: Its Effect on Job Satisfaction and Job Performance. MS thesis, SLSR-32-72. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, 1972 (AD-750 850).

32. Morrison, David C. "ICBM Vulnerability," Bulletin of the Atomic Scientists, 22-29, November 1984.

33. Nie, Norman H. and others. Statistical Package for the Social Sciences (SPSS) (Second Edition). New York: McGraw-Hill Book Company, 1975.

34. Oldham, Greg R., J. Richard Hackman and Jone L. Pearce. "Conditions Under Which Employees Respond Positively to Enriched Work," Journal of Applied Psychology, 395-403, August 1976.

35. Orpen, Christopher. "The Effects of Job Enrichment on Employee Satisfaction, Motivation, Involvement, and Performance: A Field Experiment," Human Relations, 32: 189-217 (1979).

36. Parson, Nels A., Jr. Missiles and the Revolution in Warfare. Cambridge: Harvard University Press, 1962.

37. Pierce, John L. and Randall B. Dunham. "Task Design: A Literature Review," Academy of Management Review, 83-96, October 1976.

38. Postol, Theodore A. "Strategic Confusion--With or Without Nuclear Winter," Bulletin of the Atomic Scientists, 41: 14-17 (February 1985).

39. Roberts, Karlene H. and William Glick. "The Job Characteristics Approach to Task Design: A Critical Review," Journal of Applied Psychology, 66: 193-217 (1981).

40. Ropelewski, Robert R. "Soviet Weapons Gains Spur U.S. Strategic Modernization," Aviation Week & Space Technology, 122: 25-40 (18 March 1985).

41. Schweibert, Ernest G. A History of the U.S. Air Force Ballistic Missiles. New York: Frederick A. Praeger, Inc., Publishers, 1964.

42. Steel, Robert P. Lecture materials distributed in OS 542, Management and Behavior in Organizations. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, March 1985.

43. Szilagyi, Andrew D., Jr. Management and Performance (Second Edition). Glenview IL: Scott, Foresman and Company, 1984.

44. Townsend, Maj Gene E. "Air Force Maintenance--Issues and Challenges for the Eighties," Air Force Magazine, January 1980.

45. Turner, Arthur N. and Paul R. Lawrence. Industrial Jobs and the Worker. Boston: Harvard Graduate School of Business Administration, 1965.

46. Umstot, Lt Col Denis D., Cecil H. Bell, Jr., and Terrence R. Mitchell. "Effects of Job Enrichment and Task Goals on Satisfaction and Productivity: Implications for Job Design," Journal of Applied Psychology, 379-394, August 1976.

47. Umstot, Lt Col Denis D. and Lt Col William E. Rosenbach. "From Theory to Action: Implementing Job Enrichment in the Air Force," Air University Review, 31 (March-April 1980).

48. U.S. Department of the Air Force. Classification Regulation for Enlisted Personnel. AFR 39-1. Washington: Government Printing Office, 10 May 1983.

49. -----. Maintenance Management Policy. AFR 66-1. Washington: Government Printing Office, 21 April 1983.

50. Vroom, Victor H. Work and Motivation. New York: John Wiley & Sons, Inc., 1964.

51. Yorks, Lyle. Job Enrichment Revisited. New York: AMACOM, 1979.

# VITA

Craig J. Price was born on 19 April 1958 in Baltimore, Maryland. After 18 years in "the land of pleasant living," he entered the United States Air Force Academy where he earned a Bachelor of Science Degree in Biological Science.

On the eve of his graduation in May 1980, he was commissioned as a Second Lieutenant in the United States Air Force. After attending technical training, Captain Price was assigned to the 390th Strategic Missile Wing at Davis-Monthan AFB, Arizona. There he served as a deputy commander and then commander of operational missile crews, and performed duty in both the wing's training and standardization/evaluation branches. The deactivation of the Titan II weapon system resulted in orders to Wright-Patterson AFB and the Air Force Institute of Technology's Graduate Logistics Management curriculum. Upon graduation, Captain Price will depart to Missouri where he will join the ranks of the Whiteman AFB missile maintenance deputate.

Captain Price is married to the former Clare R. Bendgen, also of Baltimore, and they have two children, Gillian and Eric.

Permanent address: 10010 Magledt Avenue
Baltimore, Maryland 21234

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

## REPORT DOCUMENTATION PAGE

| | |
|---|---|
| 1a. REPORT SECURITY CLASSIFICATION<br>UNCLASSIFIED | 1b. RESTRICTIVE MARKINGS |
| 2a. SECURITY CLASSIFICATION AUTHORITY | 3. DISTRIBUTION/AVAILABILITY OF REPORT<br>Approved for public release; distribution unlimited. |
| 2b. DECLASSIFICATION/DOWNGRADING SCHEDULE | |
| 4. PERFORMING ORGANIZATION REPORT NUMBER(S)<br>AFIT/GLM/LSMA/85S-65 | 5. MONITORING ORGANIZATION REPORT NUMBER(S) |
| 6a. NAME OF PERFORMING ORGANIZATION<br>School of Systems and Logistics<br>6b. OFFICE SYMBOL (If applicable)<br>AFIT/LS | 7a. NAME OF MONITORING ORGANIZATION |
| 6c. ADDRESS (City, State and ZIP Code)<br>Air Force Institute of Technology<br>Wright-Patterson AFB, Ohio 45433 | 7b. ADDRESS (City, State and ZIP Code) |
| 8a. NAME OF FUNDING/SPONSORING ORGANIZATION<br>8b. OFFICE SYMBOL (If applicable) | 9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER |
| 8c. ADDRESS (City, State and ZIP Code) | 10. SOURCE OF FUNDING NOS.<br>PROGRAM ELEMENT NO. / PROJECT NO. / TASK NO. / WORK UNIT NO. |
| 11. TITLE (Include Security Classification)<br>See Box 19 | |
| 12. PERSONAL AUTHOR(S)<br>Craig J. Price, B.S., Captain, USAF | |
| 13a. TYPE OF REPORT<br>MS Thesis<br>13b. TIME COVERED<br>FROM _____ TO _____ | 14. DATE OF REPORT (Yr., Mo., Day)<br>1985 September<br>15. PAGE COUNT<br>190 |
| 16. SUPPLEMENTARY NOTATION | |
| 17. COSATI CODES<br>FIELD: 05 / GROUP: 10 / SUB. GR. | 18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)<br>Job Characteristics Theory, Missile Maintenance Personnel (Enlisted), Job Satisfaction, ICBM, Motivation, SAC Missile Maintenance Complex |

19. ABSTRACT (Continue on reverse if necessary and identify by block number)


Title: AN APPLICATION OF THE JOB CHARACTERISTICS MODEL TO ENLISTED STRATEGIC AIR COMMAND MISSILE MAINTENANCE CAREER FIELDS

Thesis Chairman: Dennis E. Campbell
Assistant Professor of Maintenance Management


Approved for public release: IAW AFR 190-17
LYNN E. WOLAVER 11 Sept 85
Dean for Research and Professional Development
Air Force Institute of Technology (AFIT)
Wright-Patterson AFB OH 45433

| | |
|---|---|
| 20. DISTRIBUTION/AVAILABILITY OF ABSTRACT<br>UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☐ DTIC USERS ☐ | 21. ABSTRACT SECURITY CLASSIFICATION<br>UNCLASSIFIED |
| 22a. NAME OF RESPONSIBLE INDIVIDUAL<br>Dennis E. Campbell | 22b. TELEPHONE NUMBER (Include Area Code)<br>513-255-4149<br>22c. OFFICE SYMBOL<br>AFIT/LSMA |

DD FORM 1473, 83 APR EDITION OF 1 JAN 73 IS OBSOLETE.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE

This study investigates the job attitudes of enlisted missile maintenance technicians (in the 411X0, 411X1, and 411X2 career fields) performing duty at each of the Strategic Air Command's six Minuteman missile wings. The overall objective of the research was to determine whether a job enrichment program might hold potential for enhancing both the quality of work life and the individuals' work motivation. The methodology consisted of measuring levels of worker satisfaction with several dimensions of the work and work environment. The instrument used to collect sample data was the "Job Diagnostic Survey."

Career intent disclosures revealed that only 37 percent of the workers surveyed had definite plans to remain in the Air Force. Forty-seven (47) percent of the technicians who did not express definite positive career intent indicated that their job was the major factor influencing their decision. Compared with a sample population of non-managerial workers, results of testing for job satisfaction showed several dimensions of the work itself to be above the national norm, while many dimensions of the contextual work factors were not; among those technicians who exhibited dissatisfaction with their jobs, the work environment factors were most highly associated with this attitude. Analysis of growth satisfaction (the variable determined to be most highly associated with job satisfaction) revealed no significant difference between it and the national norm. The distinct absence of significantly positive indices for any of the three affective work outcomes (including job satisfaction) and the implication that a majority of the respondents were either undecided about re-enlisting or were intending to separate indicated that job satisfaction was problematic.

Results of a diagnostic analysis of the work itself show that a comprehensive job enrichment program in the three career fields is not warranted; however, attention should be given to contextual job factors.